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A
DISSERTATION
ON
THE PATHOLOGY
OF THE
HUMAN FLUIDS.



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INAUGURAL DISSERTATION

ON *My. July 4. 1814*

THE PATHOLOGY

OF THE

HUMAN FLUIDS.

BY JACOB DYCKMAN, A. B.

MEMBER OF THE MEDICAL AND SURGICAL SOCIETY OF THE
UNIVERSITY OF NEW-YORK.

*Nec vitæ solum sanguis autor est ; sed pro ejus vario discrimine, sanitatis etiam, morborumque
causæ contingunt. Harvey.*

NEW-YORK:

PRINTED FOR THE AUTHOR BY VAN WINKLE AND WILEY,
Corner of Wall and New-streets.

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AN
INAUGURAL DISSERTATION
ON
THE PATHOLOGY
OF THE
HUMAN FLUIDS.

SUBMITTED
TO THE PUBLIC EXAMINATION
OF THE
TRUSTEES OF THE COLLEGE OF PHYSICIANS AND SURGEONS
OF THE UNIVERSITY OF THE STATE OF NEW-YORK,
SAMUEL BARD, M. D. PRESIDENT,

FOR THE
Degree of Doctor of Medicine,

On the 4th day of May, 1813.

7031

TO
DAVID HOSACK, M. D.

F. L. S. LONDON;

Professor of the Theory and Practice of Physic and Clinical Medicine in the University of the State of New-York; Vice President of the Literary and Philosophical Society of New-York; Fellow of the American Philosophical Society, and of the College of Physicians at Philadelphia; Member of the Literary and Philosophical Society of Preston; Honorary Member of the Royal Medical and Physical Societies of Edinburgh; Corresponding Member of the Medical Society of London, and of the Massachusetts Historical Society, &c.

SIR,

TO YOU I dedicate the following Dissertation. With much pleasure I embrace the present opportunity of acknowledging the obligations, which have arisen from a long and faithful course of instruction, imparted to me in your private medical school; and most cheerfully do I thus make public those feelings of gratitude and personal regard which I have ever cherished since the relationship of preceptor and pupil has existed between us. But, independent of these considerations, I know no one to whom with so much propriety these pages can be inscribed as to you. They are written in support of those fundamental principles which have been inculcated by the most eminent philo-

sophers who have adorned the science of medicine, and which you, Sir, in your professorial lectures in the University, have illustrated with distinguished ability and success.

Convinced, as I am, that these principles are founded in truth, and will lead in their consequence to important results in practice, I have endeavoured to adduce such additional proofs in their support as some small share of reading and observation have enabled me to offer. Should you do me the honour to approve this little essay, it will afford me the most ample and satisfactory compensation for all my labours.

With sentiments of the highest respect and esteem, I remain,

SIR,

Your friend and

humble servant,

JACOB DYCKMAN.

TO
JOHN W. FRANCIS, M. D.

Professor of Materia Medica in the University of the State of New-York; Member of the Society for the Promotion of Useful Arts in the State of New-York, and of the New-York Historical Society; Corresponding Member of the Massachusetts Historical Society; Fellow of the Literary and Philosophical Society of New-York, &c.

SIR,

I HAVE prefixed your name to this performance, in commemoration of the friendship which has, for many years, existed between us, and as a testimony of the respect which I entertain for your professional standing, and of that esteem I cherish for the uniform integrity and purity of your moral character. Permit me here to express the wish, that your success in promoting the best interests of that liberal and enlightened profession of which you are a member, may be commensurate with your talents and unremitting exertions; and that the career so auspiciously commenced may remain unchecked by misfortune or reverse:

In perfect sincerity, and with sentiments of the truest personal regard, I subscribe myself

Your friend,

J. DYCKMAN.

PREFACE.

THE object of the following Dissertation is to exhibit a concise and systematic Pathology of the Human Fluids, or a view of their various morbid affections, with their differences, causes, and effects. The present inquiry relates more especially to the blood, or vital fluid, which is not only universally distributed throughout the body, but is the source from which all the other humours are derived. When the blood, therefore, becomes vitiated, the secretions will necessarily partake of the affection.

All the disorders of the fluids, considered in themselves, have a reference either to their quantity or their quality. The subject matter of these pages has, accordingly, been arranged under two general divisions: the first of which embraces the *morbid qualities of the fluids*. These, again, may be comprised under three heads; *morbid fluidity, acrimony, and putrescency*. The second relates to the *morbid quantity of the fluids*; under which head are considered the doctrines of *Plethora*.

In perusing the following pages, it will be seen, that the author has made constant reference to the writings which he has consulted. His motive in so doing was not only to give credit to the intellectual labours of others, but also to present the original authorities upon which any facts and opinions are supported, and to direct the reader to any further illustration which they may afford.

It may here be proper to remark, that the present Dissertation was originally submitted, in manuscript, to the examination of the Trustees of the College of Physicians and Surgeons, in May, 1813, for the purpose of receiving the honours of the medical doctorate in the University of New-York. Believing the doctrines which he then attempted to maintain, to be founded on well-known physiological and pathological principles, and eminently calculated to advance the practical interests of the profession, the author was afterwards induced to enter more fully into an illustration and defence of the tenets he had espoused.

It would be unnecessary here to offer the various reasons that have induced the author to adopt the opinions attempted to be supported in the following pages. His reasons are, with more propriety, unfolded in the course of the work. When he first entered upon the consideration of this inquiry, he entertained no particular sentiments concerning the result. He owes his conviction of the truth and practical importance of the prin-

ciples he now supports, to a patient investigation of the subject, and, he believes, to an impartial and unprejudiced examination of facts, and of the observations and opinions of the most approved writers.

Of the numerous topics of pathological investigation, few are more deserving attention than the doctrine of the fluids; and from the manner in which the inquiry has been conducted, none, perhaps, has afforded more abundant room for animadversion. Hence, whether the solids or fluids are primarily affected, and how far these latter are ever the subject of disease, are questions which have been discussed in all the bitterness of controversy. Discussion, though in an eminent degree calculated to lead to the discovery and development of truth, loses much of its importance in this respect, when influenced by prejudice, or by passion. "Science disdains the spirit of party, and philosophy herself weeps at the madness of sectarians."*

The author must again repeat, that he cannot but believe that the doctrines attempted to be supported in the present performance, as they are founded upon a general, and not a partial view of the human fabric, will lead to consequences the most auspicious to humanity. Empires and science are subject alike to revolution, and as the for-

* Dr. JOHN W. FRANCIS.

mer, after being the victim of usurpation, not unfrequently again revert to legitimate dominion, so is it incident to the latter to revive those well grounded truths which may have been exploded by the fashionable theories, or the prevailing philosophy, of the day. It may here, too, be observed, such has been the force of authority since the appearance of the systematic writings of CULLEN, and still more lately, those of BROWN, DARWIN, and their disciples, that the teachers in the most celebrated schools of medicine have been wholly regardless of the fluids as a constituent and essential part of the animal economy. May the author be permitted to add, that the honour of restoring this pathological principle, as founded upon the most prominent facts which the science affords, and the most striking results which animal chemistry presents, has been reserved for this country, and for the present teacher of the Theory and Practice of Physic in the University of New-York.

THE AUTHOR.

New-York, March 4, 1814.

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A
DISSERTATION
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INTRODUCTION.

To explore the nature and causes of disease; to trace their operation upon the animal machine; to determine those morbid dispositions of body which must concur with the remote or possible causes before any one general symptom of disease can take place; to ascertain the changes or conditions in the state of the corporeal frame which are essential to, and invariably productive of, the different species of morbid affections, is one of the most important, and, at the same time, one of the most difficult undertakings in the whole science of medicine.

Many are the ingenious theories and hypotheses, many the plausible systems that have been formed on this subject, and which have been successively published from the earliest periods of physic down to the present time. Of these several systems, each has had its votaries, who have for a time supported its credit, and given to its doctrines a gay and flourishing appearance; but they have at length yielded to others more novel, or more captivating, or, perhaps, better fitted to the state of medicine, and to the prevailing philosophy of the age. Such has uniformly been the fate of nearly all the various doctrines of medicine that have as yet been offered to the world; principally from their having been the offspring of conjecture, without the support of facts and observations, the only grounds and principles of all true and rational philosophy. But this solid foundation appears to be wanting in most of the several systems of physic hitherto invented; of consequence, time betrays their weakness, and they fall of themselves to ruin. The philosophy of the ancients, indeed, was so extremely limited with regard to our internal economy, or the

laws by which our animated system is governed, that they had not sufficient data for establishing any thing of a general pathology explanatory of the various morbid conditions of the human frame. And the moderns, notwithstanding their superior advantages, and the favourable turn to our medical philosophy, have not made such advances as might have been expected. We are still greatly in the dark with regard to the internal economy, over many of the operations of which nature appears to have drawn an impenetrable veil.

The whole material world has been, not improperly, divided into *solids* and *fluids*, as being the only essential states of matter we are able to observe. In compliance with the mode of expression usual among medical writers, the corporeal part of man may be said to be composed of both these conditions of matter, being nothing else but a fine contexture of *solids* and *fluids*, which are fitted by the laws of nature for different purposes, and by their various motions are productive of all the phenomena of animal

life.* And in correspondence with the views which physicians of different ages of the world have taken of the animal body, and of the influence which these two component parts were supposed to exert upon the organized living system, the seat and cause of disease have, at different periods, been almost exclusively referred either to the solids or to the fluids.

But, as an ingenious author† has observed, there are *fashions* in physic as well as in every thing else, and it is to be regretted that in our transition from one theory to another, we run too much into extremes. For here it falls out, as in most other disputations, we err in carrying things too far. The *humoral pathology*, as it is called, under various modifications, prevailed universally in the schools of physic for a great length of time. Diseases were supposed to have

* Corpus humanum constat e partibus solidis et fluidis, quarum mutua actione, functiones vivi hominis (quatenus corporeæ sint) peraguntur. GREGORY, *Conspectus Medicinæ*, § 69.

† WALKER, *An Inquiry into the Small Pox*, p. 59.

their seat chiefly, if not entirely, in the animal fluids or *humours*; and to their changes or disordered conditions were principally attributed all morbid phenomena. This doctrine, or opinion, notwithstanding it gave a very improper and fallacious idea of many diseases, was so generally received, and so warmly espoused, that although others were occasionally proposed, they were, by the generality of physicians, considered only as *innovations*, and were, in general, but of short duration.

Of late, however, the opposite doctrine appears to have been generally received, and it has now become fashionable to refer all morbid phenomena to the different affections or conditions of the *solids*, without any regard to the influence of the living and circulating humours. The respective writings of WILLIS* and BAGLIV† seem to have given the first hint, that a consideration of the different affections or conditions of the living solids, would, in general,

* Pathologia Cerebri et Nervorum.

† De fibra motrici et morbosa.

afford the most probable grounds of disease, and a more rational and satisfactory explanation of many morbid phenomena, than that of the derangements or disordered conditions of the animal fluids. The celebrated HOFFMAN,* however, was the first who put physicians in the proper train of investigation, reduced this doctrine to any tolerably clear and simple form, and satisfactorily pointed out any extensive application of it in the explanation of diseases, or in unfolding the various occurrences in the morbid conditions of the animal body. But it is in the writings of the learned and ingenious CULLEN† that a far more bold and general appeal is made to the agency of the living solids, or *moving powers* of the body, and their various affections, as constituting the essence of much the greater number of diseases. And, lastly, in the systematic works of BROWN‡ and DARWIN,§ all consideration of the changes or condi-

* Medicin. Rational. System. tom. 3. sect. i. cap. 4.

† First Lines.

‡ Elementa Medicinæ.

§ Zoonomia, or the Laws of Organic Life.

tions of the humours, as the origin of disease, is wholly rejected, and the phenomena of life, whether in a state of health or disease, are exclusively referred to the various action of the moving fibres, and to the agency of the nervous energy, or sensorial power, resident in the living solids.

From a due consideration of the nature, functions, and composition of the living human body, to us it appears that these two opposite doctrines, namely, that of the *fluids* and that of the *solids*, have both been carried too far; and while one party have supported one opinion, and the other the very reverse, the probability is, that no disease of the constitution can take place without involving every part of our system, affecting the condition of the solids as well as that of the fluids. For such is the universal sympathy, and such the continual intercourse incessantly kept up between these component parts of our body, that in health they mutually assist and support each other, and are fitted by the laws of nature for the different purposes of the animal economy; in like manner, in the morbid

state they sympathize together, and reciprocally communicate their affections.

By the human body we are to understand, what it really is, a whole, in which the various parts have different and various properties, which compel them to act in conformity to these same properties, and which keep them in perpetual action and reaction on each other. Its various instruments and powers are but parts of one stupendous whole, and so intimately connected, and so mutually influencing the actions and conditions of each other, as to produce but one continued and perpetual circle of motions, some of which are influenced by others, and could never be completed without all their parts or instruments being duly arranged, and in their proper places. For example, the blood, which is the primogenial part of the animal embryo,* is the first cause that excites the heart into action,† and by its perpetual stimulus or impression,

* HARVEY, De Generatione Animalium.

† Certumque est, visiculam dictam, ut et cordis auriculam postea, (unde pulsatio primum incipit) a distendente sanguine, ad constrictionis motum irritari. *Ibid. Exercit. 51.*

forever after determines and keeps up the motions of this organ.* And again, the heart itself borrows its motory power from the nervous energy, which latter presupposes the circulation of the blood, and its constant impression upon the brain and spinal marrow. And so of all the other principal parts of our system. Hence the beauty and perfection of the animal circle! The living and moving solids, by their energies and action, propel the blood and humours, and preserve them in a renovated and healthy state, whilst these again, by stimulating the vessels which contain them, keep up their due and necessary motions, and at the same time are fraught with what is necessary to replace the various expenditures of the system, whether of substance, vigour, or vitality. Hence the truth of what is so beautifully observed by HIPPO-

* Qui hos experimentorum nostrorum eventus pensitaverit, is quidem non dubitabit nobiscum pronunciare, causam, quæ cor in motum ciet, omnino sanguinem venosum esse: nam enata ea causa cor movetur, subtracta quiescit, diminuta motus cordis languet, aucta motus intenditur. HALLER, *Elem. Physiol. Corp. Hum. tom. i. p. 495.*

CRATES, that "every thing in the human body is so disposed in manner of a circle, that you will find the end where you would look for the beginning, and the beginning where one might expect the end."*

But, notwithstanding all the several powers and instruments of the body are necessary to the energy and uniform operations of the whole, yet certain parts thereof seem to hold a primary, and others a subordinate importance. Sensation and the circulation of the blood are the last signs of life; and life itself, according to a celebrated French physiologist,† is produced by an impression of the arterial blood made upon the brain and medulla spinalis, or a principle resulting from that impression. The nervous and vascular systems may, therefore, be esteemed the prime essentials of life, and the immediate cause of the animal motions; and, of

* Εμοὶ δοκεῖ ἀρχὴ μὲν οὐκ οὐδεμία εἶναι τοῦ σώματος, ἀλλὰ πάντα ὁμοίως ἀρχὴ καὶ πάντα τελευτή· κύκλου γὰρ γραφέντος ἀρχὴ οὐχ εὐρέθη.

De Locis in Homine.

† LE GALLOIS.

consequence, the consideration of these will always form the leading doctrines of true and rational pathology.

From what has been said in the preceding pages, it appears that the *animal body* is a machine, delicate in its texture, consisting of solids and fluids, which, by their various properties and mode of action, are productive of all that peculiar assemblage of motion which constitutes life; and that health itself consists in the regular and equable motions of these component parts, together with proper conditions thereof; and that diseases are their aberrations.

From this general, though imperfect, view of the animal economy, it is easy to apprehend that the animal motions may be disordered, and diseases brought on by a great variety of causes: for whatever too much increases or diminishes the nervous or vital energy; whatever too much excites or depresses the actions of the moving fibres; whatever renders the fibres too dry, elastic, and tense, or too moist, flaccid, and weak; whatever over and

above increases or diminishes the quantity of circulating humours; whatever renders the blood too dense, thick, and viscid, or too thin, limpid, and serous; whatever loads and impregnates this fluid with too large a proportion of active, acrid, putrescent particles, or with too many sluggish, poor, and watery corpuscles; whatever creates in the humours a tendency towards an alkaline, or putrescent disposition; whatever inordinately promotes or retards any of the secretions or excretions; and, lastly, whatever increases or diminishes the force or velocity of the circulation, or augments or rebates the vital heat and energy of the body, beyond a certain degree, will affect or disturb the animal motions, and thus become the primary and immediate cause of some disease or other.

Seeing, then, the various changes in the habit whence disorders may proceed, it would seem surprising that diseases are not more frequent, or that the animal body should be able to hold out to extreme old age. But we are to recollect "that nature assumes some latitude in

her operations without injury to the body,"* and therefore, as GALEN† has well remarked, what is called health, is neither absolute nor indivisible, but admits of considerable latitude; by virtue of which the solitary alienation of any one part, or small deviations from the natural standard of health, seldom affect the integrity of the functions; so that disease only breaks out at last when the evil has become more considerable, and been more widely diffused.‡ To the production of disease, therefore, as physicians justly affirm, there is required a particular *combination* of causes,§ no single one, however powerful, being sufficient for this purpose, without the concurrence of others: and yet that which alone

* GARDINER, Observations on the Animal Economy, p. 17.

† Non enim absoluta ipsa est, nec indivisibilis simul, quæ est et dicitur sanitas, verum etiam quæ ab hac deficit, modo adhuc usibus nostris non sit inepta. GALEN, *De Sanitate tuenda*.

‡ Inest etiam in sanitate robur aliquod, quo se adversus vitia singularia tuetur, nec a solitaria cujusvis partis alienatione functionum suarum tenorem mox perturbari sinit: ut adeo plerumque morbus tum demum erumpat, cum latius se diffudit malum. GAUBII *Pathologia*, § 123.

§ BLANE, Diseases of Seamen.

produces no visible effect, as CELSUS observes, often proves extremely efficacious in conjunction with others; so that we in general adjudge that to be the cause of a disease which apparently most contributes to its production.*

As health consists in a proper harmony and regularity of the animal motions; so disease, on the contrary, is this harmony destroyed, and evidently consists in the production of a new series, a new order of motions and things. To the regulated and necessary actions which conspire to produce life and health, succeed those determinate actions that concur to produce disease and dissolution. But all the animal motions are the result of the joint influence and co-operation of the different solids and fluids of the body; and therefore it is in the changes or disordered conditions of either the one or the other, or of both these, that we are to look for

* Nihil omnino ob unam causam fieri, sed id pro causa apprehendi, quod contulisse plurimum videtur. Potest autem id, dum solum est, non movere, quod junctum aliis maxime movet. *Li Præfat. lib. i. p. 16. Ed. 1730.*

the causes of disease. The various affections of the living and inert solids, it is true, will be found to be the cause of disease much more frequently than the various state and changes of the several animal fluids; but this surely is no good reason for rejecting altogether the agency of the latter, or for denying either the possibility of a fault in the humours, or, that they are capable of affecting, by their different condition, the motions or state of the living or inert solids. The blood being the true stimulus to the action of the heart and arteries, it is easy to understand that this fluid will be differently qualified for this purpose, according to the different state of its sensible or chemical properties. Thus, *ceteris paribus*, a dense, rich blood, will be capable of impressing and receiving the force of the heart and blood vessels more fully, and, consequently, of producing a more general excitement throughout the system, and a higher degree of the vital heat and motions, than a weak, impoverished, or serous blood. It is upon this principle that the learned HALLER observes, “*Calor cum densitate sanguinis increscit, et cum aquosa ejus tenuitate ita minuitur, ut aquosus cruor, etiam ve-*

hemerter motus, calorem non parem generet, aquæ exemplo, quæ celerrimo motu levissime intepescit, et feminarum teneriorum, quas neque hystericæ convulsiones, neque febres ad eum gradum calefaciunt, qui in sano agricola nascitur.* But it is deemed unnecessary longer to dwell upon the importance of attending to the different states of the blood, and the impressions which they are capable of making upon the general system. Suffice it to say, that this humour is the primitive principle of all animal substances, the common origin of all the animal solids and fluids; and when it is well constituted, and performs its proper office, conveys life, motion, vigour, nourishment, in a word, health, to every part of the organized machine: so, on the contrary, the mass of blood being vitiated, or disorderly moved, becomes a source of much aggravation to the system, and the cause of many morbid effects. That the blood and other humours of the body are capable of admitting morbid or preternatural qualities, is a fact demonstrated by daily experience,

* HALLER, Elem. Physiol. tom. 2. p. 150.

and the uniform observations of physicians of every age and country. The colour, texture, consistence, and other sensible qualities of the blood, are liable to various alterations. Sometimes the humours appear to undergo decomposition in the body, as *in vitro*. In the scurvy, in putrid, malignant, pestilential fevers, &c. we observe all the phenomena of a degeneration and complete disunion of the different principles that compose the blood, the texture of which in some instances appears to be nearly destroyed. In such cases, it seems as if the vital principle abandoned the government of the corporeal frame, and left the solids and fluids to the destructive action, of external agents; in consequence of which they tend to putrefaction, and become decomposed, as they usually do when separated from the body, or when the principle of life or animality is extinguished. To ascertain these several morbid affections of the blood, with their various causes, signs, and effects, is the object of the following Dissertation. But in conformity with the generally received axiom, *Rectum est sui et obliqui*, before entering upon the consideration of the

pathology or morbid state of this fluid, it will be necessary to offer a few observations on its natural history, and its appearances when in a sound condition; by comparing with which its qualities and accidents when diseased, it will not be difficult to refer the several vitiations to their proper heads or classes.

ON
THE MORBID QUALITIES
OF
THE FLUIDS.

THE several vitiations or morbid *qualities* of the circulating fluids, which we are now to consider, will be comprised under one or the other of the following heads; namely, *morbid fluidity*, *acrimony*, and *putrescency*. But before we attempt to establish conclusions from the various state of the blood when drawn from diseased persons, we must recollect the appearances which this fluid exhibits as taken from sound persons; and, therefore, previously to entering upon the consideration of its diseases, it may be proper to premise a few observations on its natural and physiological history.

Natural History of the Blood.

The human blood, in its natural and healthy state, is a fluid possessed of a considerable degree of density and consistence,* has a viscid and tenacious feel,† a smell somewhat urinous, and peculiarly animal,‡ and is to the taste sweetish or slightly saline,§ from its containing a small quantity of sea-salt, which is sometimes discernible by the microscope,|| and therefore exists in a free and uncombined state; whence it would appear to be an accidental rather than an essential or constituent part of the blood. But notwithstanding this fluid is somewhat saltish, yet in its healthy state, uninjured by putrefaction, or too violent a degree of heat, it is neither

* VAN SWIETEN, Comment. in BOERH. Aphor. § 1174.

† MACBRIDE, Theory and Practice of Physic, p. 7.

‡ JOHNSON, Animal Chemistry, vol. i. p. 24.

§ HUNTER, Treatise on the Blood, Inflamm. &c. p. 14.

|| HALLER, First Lines, chap. 5. BOERHAAVE, Institut. Med. § 224. n. 5.

alkaline nor acid,* but perfectly bland and temperate,† and without the least sensible acrimony; for if dropped into the eye it gives no pain.‡

Blood is not so fluid as water, but necessarily possesses a sort of plastic lentor and tenacity. Its specific gravity, according to Mr. BOYLE,§ is equal to 1040; but from the more recent experiments of the accurate JURIN,|| it is estimated at about 1053. The gravity, as well as the consistence of this fluid, may vary very sensibly in different persons, according to age, sex, constitution, season of the year, and a diversity of other circumstances.

The colour, texture, and consistence of recent blood is variously affected by different reagents. Its fluidity is increased by alkalis both

* SCHWENKE, *Hæmatologia*, p. 135. BOERHAAVE, *Elementa Chimiæ*, tom. 2. proc. 114.

† HOFFMAN, tom. 2. p. 369. GAUBIUS, *Patholog.* § 290. &c.

‡ VAN SWIETEN, *Commentar.* § 32. 99. 423. &c.

§ Nat. Hist. of the Blood, Works, vol. iv. p. 167. fol. ed. 1744.

|| Philos. Trans. No. 361. JONES'S Abridgment, vol. v.

fixed and volatile, by which it is preserved from coagulation. Neutral salts, such as sal Glauberi, common salt, &c. render it in like manner more fluid, and retard its coagulation; whilst alum coagulates it immediately. It is likewise coagulated or rendered more thick by the vitriols of zinc, iron, and copper, by concentrated spirit of wine, by the mineral acids, and by most of their combinations with earthy and metallic bodies.*

But the vegetable acids in general produce no coagulation.† Acetum, according to BOERHAAVE‡ and SCHWENKE,§ rather dissolves or attenuates the blood, and hence it is recommended as a deobstruent by the former.

* *Vide* HALLER, Elem. Physiol. tom. 2.; JOHNSON, Animal Chemistry, vol. i.; HEWSON, Experimental Inquiries; HUXHAM, on Fevers; CHAPTAL, Chemistry, part v.; BOYLE, Natural History of the Blood; BOERHAAVE, Elem. Chem. tom. 2. proc. 127.

† HALLER, *in loc. cit.*

‡ Elem. Chem. tom. 2. proc. 50.

§ Hematologia, vel Sanguinis Historia.

It would be unnecessary longer to dwell upon the effects of reagents upon the blood; for we must not conclude that their effects upon this fluid, whilst in the body, and under the control of the vital principle, or the action of the heart and vessels, would, in all instances, be the same as out of it. Beside, most substances which are thrown into the stomach, are so changed by the action of this viscus, as to have altogether lost their original qualities before they can gain admission into the circulation. Others, again, are less altered thereby; and some appear to pass into the circulation without any change of property, where they manifest their qualities, and produce effects upon the circulating fluids, not dissimilar to what they would when out of the body. Of this latter kind appear to be many alkaline and saline materials, which are altogether indigestible. Sea-salt, accumulated in the habit in a certain quantity, has long been considered *one* immediate cause of scurvy;* and, indeed, the records of medicine are not

* *Vide* CULLEN, First Lines;—also LIND on the Scurvy.

wanting in facts to show that the texture of the blood may be destroyed, and the whole mass brought into a dissolved and putrescent state, by the abuse of this material.* Similar effects have followed the long and abusive use of the lixivial or alkaline salts.†

Human blood is easily putrescent, and that most readily in a temperature between 100 and 110 of Fahrenheit;‡ which includes the general range of febrile heat. Putrefaction is a means of entirely destroying the texture and cohesion of the blood, and resolving this mild and plastic fluid into a thin, acrid, and fetid sanies.§ It soon contracts a disagreeable fetor, which increases so rapidly as to become, in a few days, nearly insupportable; the crassamentum, in the mean time, loses its firmness, and begins to change the serum to a darkish red colour, and it finally

* PERCIVAL, *Essays, Medical and Experimental*, vol. ii. p. 118.

† HALLER, tom. 2. p. 90. HUXHAM, on Fevers, p. 48, 49. 303.

‡ ALEXANDER, *Experimental Inquiry*, chap. ii.

§ HALLER, tom. 2. p. 89. See also BROWNE LANGRISH, *Modern Theory and Practice of Physic*, p. 356.

becomes so dissolved as to leave only a very few threads or feces behind; and in this state it has a strong smell of volatile alkali, and effervesces with acids.* Putrid blood cannot by any art be inspissated, or made to coagulate.† To what extent the putrefaction of this fluid may proceed in the living body, may perhaps be difficult to determine; but there is evidently a tendency or an approximation to this state, in many malignant disorders where the cohesion of the blood is dissolved, and it is rendered incapable of coagulation.‡

So far with regard to the general appearances and properties of blood considered as a whole; but physiologists, to enable them the better to understand the nature of this fluid, and to ascertain the various ingredients which enter into its composition, have had recourse to the aid of chemistry; though it must be acknowledged,

* *Vide* PRINGLE, Diseases of the Army, Append.; JOHNSON, Animal Chem. vol. i. p. 26.; HALLER, First Lines, § 139.; BOERHAAVE, Elem. Chem. tom. ii. &c.

† HALLER, *loc. cit.*

‡ HUXHAM, on the Dissolved and Putrid State of the Blood.

that chemical analysis exhibits not the true principles of the blood, nor even such as are produced in a state of perfect simplicity ; however, it is of some importance in enabling us to speak more intelligibly concerning various changes and combinations that take place in the animal fluids.

Blood is by the force of fire resolvable into four species or kinds of matter ; namely, aqueous, terrene, saline, and oily or inflammable.* But fire acts upon this fluid with a strange diversity, according to the degree in which it is applied : below 100 down to 50 it attenuates and putrefies it. From 100 up to 276 it inspissates it ; and above this degree again, it attenuates it, and renders it volatile, sharp, and alkaline.†

By a more detailed and elaborate process, human blood is found to contain the following ingredients ; viz. water, fibrin, albumen, gelatin,

* *Vide* BOYLE, Nat. Hist. of the Human Blood, vol. iv. ;
HALLER, First Lines, chap. 5.

† BOERHAAVE, Elem. Chem. tom. ii. præc. 119.

hydro-sulphuret of ammonia, soda, sub-phosphate of iron, muriate of soda, phosphate of soda, phosphate of lime; besides a small portion of benzoic acid, which has been detected by PROUST.* HALES found that blood likewise contained an *aërial fluid*.†

The blood, by this analysis, is shown to be a very heterogeneous aggregate, and to contain various fluids or substances, some more ponderous and tenacious than others, some aqueous, some alkaline, others oily or inflammable; but most of them impart to the sanguineous mass a putrid or alkalescent tendency. So long, however, as these several ingredients duly allay or neutralize each other, they are altogether inoffensive to the body. But if, in consequence of putrefaction, of too violent a degree of heat and motion, or other causes, the crasis of the blood be destroyed, or its texture so opened as to dissolve the bond of union among the insensible particles, the different salts and oils of the blood

* THOMSON, System of Chemistry, vol. v. p. 602.

† HALES, Statical Essays.

are then allowed to recede from their natural combinations, and to run into others, which, being opposite to the mild and emollient nature of healthy blood, still farther dissolve the crasis of this fluid, and increase the disturbance of the motions of the living solids. For the blood in its natural state is bland, although in some diseases it is rendered highly acrimonious, and almost putrid; as, for example, in scurvy, where it corrodes its containing vessels, and runs off in profuse hemorrhages from different parts of the body: such, too, is the malignity or corrosiveness of the humours in this complaint, as in some instances to have forced open the scars of wounds, which had been many years healed; the calli of fractured bones, which had been completely formed for a long while, have been entirely dissolved; the cartilages of the sternum separated from their junction with the ribs; and the epiphyses from the body of the bones.*

* *Vide* Lord ANSON's Voyage Round the World, by the Rev. Mr. WALTER; LIND, on Scurvy; RUPPE, De Morbis Navigantium; MEAD, Discourse on the Scurvy; Account of POUFART's Dissections, in Philos. Trans. Abridg. vol. v.

We are next to take a brief view of the nature and properties of the proximate component parts of the blood, as they usually appear from spontaneous separation or decomposition.

Blood, as it flows from the vessels of a healthy person, appears to be an homogeneous fluid, of a uniform red colour and consistence; but left to itself it soon loses its fluidity, and separates into different parts. In the first place it emits spontaneously a subtle aqueous vapour, or halitus, of a smell something urinous, fatuous, or peculiarly animal.* Water impregnated with this vapour in a short time contracts a putrid odour;† whence it would appear to be a part of the blood highly animalized or loaded with septic particles. In health it is mild and bland, but acquires an acrimony from disease.‡ As this aroma escapes, the blood which remains,

* DUMAS, *Principes de Physiologie*, tom. ii. p. 33.

† JOHNSON, *Animal Chem.* vol. i. p. 56.

‡ Vapor, ex sanguine exhalans, est mitis, blandus, neque nares, neque oculos afficiens, in statu tamen præternaturali plane eodem modo, ut sudor morbificus et vapor ex ulcere manans atque evaporans, acer nares atque oculos ferit. SCHWENKE, *Hæmatolog.* p. 90.

in the mean time, settles into a tremulous coagulated mass,* which is of different degrees of firmness in different subjects.† In a few hours more or less, according to different circumstances, this coagulated mass, if kept in a temperature between 32 and 96 of Fahrenheit,‡ separates into two distinct parts; the one a light greenish yellow, or almost colourless fluid, called *serum* or *lymph*, in the midst of which floats the other, a red solid body, denominated *crassamentum*, *coagulum*, or *clot*. The cause of this spontaneous decomposition of the blood, when out of the vessels, has not hitherto been ascertained. According to the experiments of HEWSON,§ HUNTER,|| and others,¶ it is not essentially connected with the influence either of air, heat, cold, or even of motion or rest. The coagulation takes place equally in the open air, in vacuo, and in close vessels, whether the blood

* GAUBIUS, Patholog. § 336.

† MACBRIDE, Theory and Practice of Physic, p. 7.

‡ SCHWENKE, *loc. cit.*

§ Experimental Inquiries.

|| Treatise on the Blood, Inflam. &c.

¶ Vide JOHNSON, Animal Chem. vol. i.

be suffered to cool, or be constantly preserved at the temperature at which it is when it issues from the body ; nor is it prevented by agitation, by repose, or by dilution with water.

The proportion between the serum and crassamentum of the blood, appears to vary much in different persons, and even in the same person in different circumstances. In health, the most common proportion, according to the experiments and observations of Mr. BOYLE,* is equal quantities of each. BROWNE LANGRISH† estimates the crassamentum at rather more than *one half* of the whole mass of blood. But these proportions are by no means constant ; in many cases the crassamentum much exceeds, and at other times falls greatly short, of the quantity of serum. From a comparison of the observations and conclusions of most of those who have written with accuracy upon this subject, the limits of the ratios of these two substances to each other appear to be 1 : 1 and 1 : 4 or 5.‡

* Nat. Hist. of the Blood, vol. iv. p. 172. 200.

† Modern Theory and Practice, p. 73, 74.

‡ HALLER, Elem. Physiol. tom. ii. p. 47.

Owing to this great diversity in the proportion of these two component parts of the blood to each other, the gravity, consistence, and other sensible qualities of this fluid, and of consequence the impressions which it is capable of making upon the general system, and its influence upon the motions of the living solids, must be extremely various.

The *serum*, when separated from the *crassamentum*, is apparently homogeneous, spontaneously fluid, easily soluble in any quantity of cold water,* and has the smell, taste, and feel of the blood, but its consistence is not so great.† Its specific gravity, according to JURIN, is 1030.‡ It is the lightest§ part of the blood, possessing less gravity than either the *coagulable lymph*, or *red globules*, which together compose the *crassamentum*.

When chemically examined, the serum is discovered to be a compound fluid, consisting of a

* GAUBIUS, Patholog. § 338.

† THOMSON, System of Chem. vol. v. p. 597.

‡ Philos. Trans. No. 361.

§ HUNTER, Treatise on the Blood, &c.

mucilaginous substance dissolved in a water that holds in solution a small portion of neutral salts. It contains albumen, gelatin, hydro-sulphuret of ammonia, soda, muriate of soda, phosphate of soda, and phosphate of lime.*

In its recent and healthy state, this fluid is perfectly bland, and gives no evidence of a free or disengaged alkali; but it is rendered thin and acrid by putrefaction, and also acquires an alkalescency, as is manifest from its effervescing with acids.† Serum easily putrefies, but not so readily as the crassamentum,‡ and when once rendered putrid, it cannot, by any art, be inspissated;§ although in the recent state it is easily coagulable by acids, by oxides, and by alcohol.|| As HARVEY first discovered,¶ it also coagulates

* THOMSON, System of Chem. vol. v. p. 598.

† BOERHAAVE, Elem. Chem. tom. ii. proc. 114, 115.

‡ PRINGLE, Diseases of the Army, Append.

§ HALLER, Elem. Physiol. tom. ii. p. 132.

|| DUMAS, Principes de Physiologie, tom. ii. p. 37.

¶ De Generat. Anim.

by heat ; but the temperature required for this purpose has, by different writers, been variously estimated at 148,* 150,† 156,‡ and 160,§ of Fahrenheit. By this coagulation, the serum is converted into a whitish scissile insoluble mass, not unlike the boiled white of an egg, and is also separable into two parts :|| the one a fixed, solid, and somewhat tenacious substance, possessing all the properties of coagulated *albumen* ;¶ the other, which is not coagulable by these means, a thin, aqueous, and almost colourless fluid, has been termed the *serosity*, and consists principally of *gelatin*.**

The albumen, or mucilaginous part of the serum, after being coagulated by heat, is incapable of solution in the serosity, except by putrefaction, or by the addition of some chemical agent, and then it loses its original property of coagulability by heat.†† But if exposed

* SCHWENKE. † GAUBIUS. ‡ CULLEN. § HEWSON.

|| GAUBIUS, Patholog. § 338.

¶ THOMSON, System of Chem. vol. v.

** JOHNSON, Animal Chem. vol. i.

†† HEWSON, Experimental Inquiries, p. 136.

to a temperature less than that required for its coagulation, the serum will be gradually inspissated, and at length converted into a solid mass, which can be easily dissolved in water; by the addition of a due proportion of which, it may again be converted into serum, which appears to possess the same properties that it did before, particularly in being coagulable by heat.* The increased density or specific gravity of this fluid, which is said to take place in fever,† is to be attributed to a similar inspissation, the consequence of great heat or febrile excitement, which greatly dissipates the aqueous and more fluxile parts of the serum; whilst the more gross, viscid, and ponderous, that are unable to pass the constricted pores, being alone retained in the circulation, run into a closer cohesion, which necessarily augments the lentor and consistence of the whole mass of serum, and renders it less fit for diluting the other parts of the blood. Hence the necessity of

* HEWSON, *Experimental Inquiries*, p. 137.

† BRYAN ROBINSON, *HALLER'S Elem. Physiol.* tom. ii. p. 123.

plentiful dilution in all ardent continual fevers, in which the serous part of the blood, as BROWNE LANGRISH has demonstrated from a great number of experiments, is always much reduced below the proportion which it ought to bear to the crassamentum.*

The *crassamentum*, or *cruor*, as it is sometimes called from retaining the red colour which distinguishes the blood, is spontaneously solid, and possesses considerable density and consistence. Its specific gravity, according to JURIN, amounts to about 1126.† This substance, it is well known, consists of two distinct parts, namely, *red particles* and *coagulable lymph*, which appear to be partially separated by a spontaneous action, but may be entirely so, by washing the crassamentum in water.

The *coagulable lymph*, or as it is by some called the *gluten*, and by others, with more propriety, termed the *fibrous matter* of the blood, is a substance spontaneously solid, having the greatest

* Modern Theory and Practice.

† Philos. Trans. No. 361.

tendency to become concrete of all the circulating fluids; and when once coagulated, it is insoluble in water and alcohol, but is readily dissolved by the acids, and even by vinegar.*

It is this fibrous matter which imparts to the sanguineous mass its plastic lentor and tenacity, gives solidity and firmness to the crassamentum, and is the true cause of the spontaneous coagulation of the blood; for when deprived of this matter, it is incapable of concretion, a circumstance not unknown to the ancients.†

The specific gravity of the coagulable lymph is greater than that of the serum, but less than that of the red globules.‡ It putrefies with considerable facility;§ and possesses all the properties of *fibrin*.|| This fibrous part of the blood, when thoroughly freed from the red globules or colouring matter, is perfectly tasteless, and of a white colour, exhibiting a membranous texture,

* JOHNSON, Animal Chem. vol. 1.

† *Vide* ARISTOTLE, De Hist. Anim. Lib. iii. Cap. 19.

‡ HUNTER, Treatise on the Blood, &c.

§ PRINGLE, Diseases of the Army, Append.

|| THOMSON, System of Chem. vol. v. p. 599.

consisting of extensible and elastic filaments much of the nature and resemblance of muscular fibre,* which has caused a celebrated physician to assert, “*caro nihil aliud est quam sanguis concretus.*”† It is, in reality, more highly animalized than the serum, and, according to modern physiologists, constitutes the elementary principle or substance of the muscles.‡ It appears to be prepared by the very act of circulation to concur in the growth, nourishment, and augmentation of the parts of the human body. Like the red globules, it would seem to be connected with strength. Its quantity is increased in inflammatory complaints,§ but is diminished from debility, from dropsies, and also in putrid fevers, in which it appears to participate in the affection so evidently induced on the muscular organs.|| Like the serum, it is readily

* RICHERAND, Elements of Physiology; GAUBIUS, Pathol.

§ 340.

† ZACCHEUS, Quest. Med. Legal. p. 239.

‡ DUMAS, Principes de Physiologie, tom. ii. p. 36.

§ BROWNE LANGRISH, Modern Theory and Practice.

|| RICHERAND, Elements of Physiology, p. 177, 178, &c.

coagulable by heat, which, according to the observations of HEWSON,* takes place between one hundred and fourteen and one hundred and twenty and a half of Fahrenheit; a temperature but a few degrees removed above that of an acute inflammatory fever.

In inflammatory diseases, the coagulable lymph is partly separated in the blood, and covers the crassamentum in form of a white or yellowish tough crust, commonly called the *buffy coat*, or *inflammatory size*. This remarkable appearance, so frequently met with in acute disorders, appears, among all the products of the blood, to have been one of those which has principally fixed the attention of physicians. Various opinions have prevailed with respect to its nature, origin, and composition. But the perfect analogy which it bears to the fibrous matter can leave no doubt as to its nature.

Formerly, when inflammations were supposed to take their rise from lentor and obstruction, the buffy coat was deemed a certain proof that the

* Experimental Inquiries, p. 32.

blood was in a state of too great viscosity, which both rendered its circulation through the vessels proportionably more difficult, and increased its disposition to coagulability. But an ingenious modern physiologist* accounts for the formation of the buff on principles diametrically opposite, alleging that notwithstanding the apparent viscosity of the blood, after it is drawn and suffered to cool, yet while circulating through the vessels, or immediately on escaping from the body, it is in reality more fluid than in the ordinary state previous to a true inflammation, the action of which consists in an increased fluidity and a lessened coagulability of the sanguineous mass, and particularly of the coagulable lymph; for "when the arteries are acting strongly, whether the whole habit be strong or not, the coagulable lymph is more fluid, and longer in coagulating; of consequence it lets the red particles, which are the heaviest part of the blood, fall down toward the bottom before it coagulates: and upon the spontaneous separation of the crassa-

* HEWSON, Experimental Inquiries.

mentum is divided into two parts; the upper, consisting of the coagulum of the coagulable lymph alone, (which in this case is termed the buff,) the under, consisting partly of this, and partly of the red globules.* According, however, to the observations of DE HAEN† and others, the phlogistic crust is not always present in a true inflammation, and it exists sometimes where there is not the smallest sign of inflammatory action. SHEBBEARE‡ remarks that he has often observed this siziness attend the blood of persons in full health and vigour, where not the least symptom of disease had taken place, or was consequent of this appearance. This morbid aspect of the blood, then, is not of that formidable nature, or of that destructive consequence to health, which many have apprehended; neither is it a certain sign of inflammation, much less can its occurrence alone, on all occasions, indicate or determine the repeated use of the lancet;

* FORDYCE, Elements of the Practice of Physic.

† Ratio Medendi, p. 36, 37, &c.

‡ Practice of Physic, vol. ii. p. 39.

for not to mention pregnancy, in which the appearance is almost constant,* there are other circumstances under which such evacuation would be improper notwithstanding the presence of the buff: nor is it the only call for venesection; there are several morbid conditions of blood indicative of an equal or perhaps higher grade of disease, and of a more vehement call for the use of the lancet. This buff has been observed in the last stage of yellow fever,† and DE HAEN‡ has seen it as late as the twelfth day of a putrid or petechial fever. These facts clearly show that it would be improper to determine from the presence of the *size* alone, when venesection should be repeated; and yet have there been not a few who have erroneously inclined to draw such a conclusion.

It yet remains to consider the *red particles*, or *sanguineous globules*, as they are sometimes called, which are ascertained to be distinct bodies pos-

* DE HAEN, Ratio Medendi, p. 39.

† HOSACK, MS. Notes on the Theory and Practice of Physic.

‡ Ratio Medendi, p. 342.

sessing form and colour; but such is their extreme tenuity, that it is only through the medium of the microscope that they can be seen and examined; by the aid of which instrument they were first discovered in the year 1673 by the celebrated LEEUWENHOECK.* The doctrine, taught by the learned BOERHAAVE, that the blood was a fluid consisting of globules of different magnitudes, decreasing in regular series, and which he appears to have embraced on the authority of LEEUWENHOECK, who imagined that he observed, with the aid of his glasses, that six serous globules, which, when separate, were of a yellow colour, combined together to form one red globule, is now pretty generally exploded.

These globular bodies are highly soluble in pure water, but in the serum of the blood they are wholly insoluble, being merely diffused or suspended in this fluid, and not chemically dissolved; and it is by means of this vehicle, too, that they are rendered movable through the

* HALLER, Elem. Physiol. tom. ii. p. 51.

vessels; for, of themselves, they appear incapable of constituting a fluxile mass. The colour, which they impart to the blood, varies in intensity according to the different state of weakness or strength, of disease or health, and is of a lighter or darker shade as derived from arteries or veins. In health and vigour, the blood is generally of a bright and lively red; but is more pale in dropsies, and in subjects of weak or enfeebled constitutions; and, in general, in proportion to the depth of its tint will be its density, consistence, saltness, and odour.* In judging of the state or qualities of the blood, therefore, CELSUS very properly recommends an attention to its colour as well as to its other habitudes.†

Physiologists have not, perhaps, as yet, clearly ascertained the several uses to which the globules are subservient in the economy; they ap-

* RICHERAND, Elements of Physiology.

† *E vena cum sanguis erumpit, colorem ejus habitumque oportet attendere. Nam si is crassus et niger est, vitiosus est; ideoque utiliter effunditur: si rubet et pellucet, integer est; eaque missio sanguinis adeo non prodest, ut etiam noceat, proptinusque is suppressendus est. CELSUS, lib. ii. cap. 19.*

pear, however, to be connected with strength, and to be necessary to the due excitement of the heart and arteries. We have already shown,* that the blood is the natural stimulus, the presence of which determines the contractions of the heart; and though it may be supposed that all the parts of the blood contribute to this end, yet doth it appear probable that this property is more especially inherent in the sanguineous globules, which, from being the most dense and ponderous part of the blood, are necessarily more eminently calculated for impressing and receiving the force of the heart, and also for keeping up its vibrations, as well as those of the arteries.† Hence it is easy to understand why the generation of heat should be said to be the principal use of the globular part of the blood; and that its quantity should be found propor-

* See p. 24, 25.

† Nempe eadem semper vi cordis posita, momentum sanguinis cum ejus densitate crescit. Creditum est, etiam cor melius a densiori sanguine stimulari, cum procul dubio fibræ cordis internæ profundius a ponderosiori sanguine emoveantur, et canis dispereat, quando ab impulsa aqua sanguis nunc valde diluitur. HALLER, *Elem. Physiol.* tom. ii. p. 149.

tionate to the natural temperature of the blood.* An exuberance of globules, therefore, by too much increasing the density and gravity of the blood, causes a higher action of all the vital motions, an augmentation of heat, and what is a necessary consequence of these, a phlogistic diathesis of body, or a strong predisposition to inflammatory complaints, or all diseases of increased circulation and temperature. It is in blood of this character, too, that the semina of contagious diseases find a more powerful pabulum.†

Agreeable to the laws of dynamics, the globules in receiving the common impulse from the heart, on account of their greater density, necessarily acquire a greater impetus, and are thus rendered efficacious, not only in propelling or setting in motion the inferior order of humours, but moreover by their vibrations and concussions they are almost as essential for digesting and farther attenuating the humours as the elastic fibres and vessels themselves; so that when,

* HALLER, First Lines, § 152.

† *Vide* WALKER, on the Small Pox.

in consequence of frequent bleedings, hemorrhages, or other causes, the blood is too much exhausted of its globules, and degenerates from its red and dense nature into an impoverished or serous state, the requisite digestion of the chyle in the blood will no longer be completed; the heart and blood vessels, from a want of due stimulation, have their motions impaired, the necessary generation of animal heat is prevented, and all the vital powers suffer a corresponding declension.*

The stability or permanence and strength of the body, therefore, depend upon a due proportion of the sanguineous globules; and health itself, which supposes a proper degree of density and consistence in the circulating fluid, can neither subsist without the thicker parts of the blood, or what is usually called the crassamentum, and a diminution of its quantity causes a stagnation in all the smaller vessels, with universal paleness, coldness, and debility: nor can the functions of life and health be maintained with-

* BOERHAAVE, *Instit. Med.*; HALLER, *First Lines*.

out the serum or fluids of the inferior orders, since the crassamentum, deprived of its aqueous portion, concretes and obstructs the straits of the vessels, impedes the cutaneous perspiration, and produces too great heat and excitement.*

We have now given a short and general analysis of the blood. We have seen that the *sanguineous mass*, or that portion of our fluids, which fills and flows in the red vessels, and is the reservoir or common source from which all the other humours seem to be derived, is, everywhere, a heterogeneous aggregate, consisting chiefly and especially of four distinct parts: to wit, *albumen*, *serosity*, *coagulable lymph*, and *red globules*, in one or the other of which are contained all the ingredients naturally belonging to the blood. When separately examined, these several parts are found, in most of their qualities and accidents, to be very distinct; some being more dense, ponderous, and cohesive, or more easily putrescent than others; some of a nature approaching to solidity, and others more tenuous

* HALLER, First Lines, § 154.

and fluxile; but when intimately intermixed or combined in the form of blood, these several parts mutually temper, or qualify each other, and constitute an entirely new and apparently homogeneous mass, of a uniform density, consistence, and fluidity throughout; which qualities of the aggregate, however, must vary with the different proportions of the proximate ingredients which constitute it as a whole. Nor, indeed, would it appear competent to the integrity of the functions, that these parts should be united in any proportions indifferently. The blood, to possess a perfectly healthy texture and consistence, adapted to all the purposes for which it is designed, would seem to require a certain mutual proportion; any considerable deviations from which must so affect the powers and qualities of the mass, as to render it less fit for the well being of the economy.* “Nor are the proportions of the elements, which we have hitherto mentioned,

* Verosimile est dari certam aliquam trium sanguinis partium proportionem mutua[m], quæ sanitati perfectæ maxime conveniat.
GAUBIUS, *Patholog.* § 353.

constant: for an active life, manhood, and fever, increase the cruor, redness, coagulability, cohesion of the parts, firmness of the coagulated serum, weight, and alkaline principles. The serum, and the mucus it contains, are increased by the contrary causes; a less mature age, inactive life, and a watery and vegetable diet; by all which, the crassamentum of the blood is lessened, and its watery part increased. Old age again augments the cruor, and diminishes the gelatinous part.”*

We have seen, too, that in combination with the insensible particles of the blood, are sulphureous, oleaginous, and different saline materials both fixed and volatile, which, in a proper quantity, appear essential toward maintaining a natural and healthy *crasis*; and so long as they hold their natural combinations, they are divested of all noxious qualities: but when, from any cause, these acrid substances are too copiously evolved, exalted, and rendered volatile, they must necessarily become sharp, acrid, and corro-

* HALLER, First Lines, § 150.

sive, and thereby, more or less, introduce a noxious acrimonious quality, which will be capable of still further vitiating the crasis of the blood, of irritating the solids, and weakening and destroying the vital powers. The occurrence of a spontaneous and noxious acrimony, however, is not very common, which, indeed, is ascribable to the constant and easy egress from the system, by the urinary passages and pores of the skin; through which *media*, the degenerating and degenerated parts of the blood are eliminated, or thrown out from the circulation.

From all that has been said, then, upon the nature of the blood; from a due consideration of its heterogeneity, the various parts of which it is compounded, and their various qualities or accidents, the diversity of their composition and properties, and the difference of the causes by which they are severally influenced, it is easy to understand that the sensible and chemical qualities of this fluid may, under different circumstances, be variously affected. For though mankind might, in the strictest sense of the word, be said to be of *one blood*,

yet different climates, seasons, modes of living, air, exercise, indolence, luxury, intemperance, different aliments, want of common necessities, or the continued use of such as are of a vitiated quality, the intervention of disease, and a variety of other causes, cannot fail, sooner or later, to affect the constitution, or to influence and diversify the nature, powers, and sensible qualities of this one animal fluid.

Having given a general view of the nature of the blood, of the effects which chemical agents have upon it, of its spontaneous separation into its proximate component parts, and of their various properties, it will be proper, in the next place, to trace the outlines of its vitiations, taking them in the order before mentioned.



Morbid Fluidity of the Blood.

FLUIDITY is that property of bodies, by which their parts, being very fine and small, are so disposed by motion and figure, as readily to yield

to any force impressed, and to be easily moved among one another in all manner of directions. In this respect, fluidity stands opposed to solidity, whose essential character is stability and firmness. All fluids differ from solids, but they differ only in the cohesion of matter, which the former in some measure possess, although small in degree; for cohesion entirely destroyed takes away the idea of a fluid as well as of a solid; so, on the contrary, when it is increased, it changes a fluid into a solid. The blood is called a fluid, because, while circulating through the vessels, and under the control of the vital principle, it is always found in a fluxile state; a property essential to its offices or functions; for, without this form, it would be incapable of a circulatory motion, or of being propelled through the flexile tubes, distributed to all parts of the living engine, and again returned to the heart. It could not be divided into different portions, as the vessels branch off, nor could it pass through the straits of the vessels, and admit of the various separation of its parts that are intended for the augmentation and repair of the whole body; nei-

ther could it be adapted for furnishing the different secretions and excretions.

The most simple affection of the blood, therefore, is that which has for its foundation a change in the state of the natural cohesion, or fluidity. A knowledge of the conditions upon which the fluidity of the blood depends, will point out the nature of its vitiations.

The force of cohesion, when natural, is not the same among all the parts of the blood ; each has its own degree by which it is fitted for the uses required ; and this cohesion being increased or diminished, fluidity will be proportionably so. The blood, when examined by the senses, as we have before shown, is found to be composed of different matters, in part fluid, another part being solid. The crassamentum, which by itself is spontaneously solid, owes its fluidity to an interfluent vehicle, by which its parts are diluted, separated, and adapted for a circulatory motion through the vessels. The varied proportion of the one to the other of these parts, therefore, will constitute different degrees of fluidity in the mass of blood, and vary the con-

sistence. Nor is the proportion between the quantities of serum and crassamentum so fixed as might, perhaps, be apprehended. HALLER observes, "In massa sanguinea media pars, et ultra, cruoris est: in robore valido serum minuitur ad tertiam partem; in febre ad quartam et quintam reducitur; in morbis a debilitate incrementum."* The gravity, consistence, and fluidity of the blood, therefore, will be equally various.

A redundancy of serum, which also increases the proportion of water in the blood, by too much diluting and attenuating the crassamentum, is productive of an aqueous tenuity of the whole mass of circulating fluids, and of the diseases occasioned by serous congestions, or by a want of due motion and heat.

An exuberance of crassamentum, on the contrary, or in other words, a paucity of serum, by admitting a nearer approximation, and more close and obstinate attraction between the gross and viscid parts of the blood, so as to favour their union into larger and more dense particles,

* *Primæ Linæ Physiologiæ*, § 138.

is productive of a preternatural spissitude and viscosity of the whole sanguineous mass, or at least of such a glutinous adhesiveness of its parts, as impedes or prevents its free and equable circulation through the different orders of vessels.

The fluidity of the blood, then, may be faulty, or preternaturally affected in two ways, either by an excess or defect of fluidity; the former vitiation is denominated *tenuity* and *resolution*; the latter *spissitude* and *viscosity*.

Tenuity of the humours, which indicates an excess of fluidity, is of different kinds. The first and most simple species may be called the *aqueous*, which is caused by a redundance of serum, or water, in the humours, by which interfluent medium, the other constituent parts of the blood are too much separated, and the globular part being diffused into too small particles, too loosely cohering, are attenuated, and the whole mass of humours becomes preternaturally thin and fluxile.*

* GAUBIUS, Patholog. § 287.

This state of the humours arises from the external and internal abuse of watery things; a scanty, or a little nutritious diet; depraved concoction in the stomach, lungs, and other viscera; torpor and debility of the heart and blood vessels; a sedentary, inactive life, especially in a moist atmosphere; suppression of the usual watery excrements by the pores of the skin, and by the urinary passages, either from cold, or from some vice in the organs themselves; too copious and frequent evacuations of blood, which unbends the force of the heart and vessels, produces a languid circulation, diminution of vital heat, and a consequent retention of the usual watery excretions.*

The consequences of this thin and impoverished state of the blood, are want of due excitement in the heart and arteries; torpor of all the functions; defective heat and nourishment; and the solids themselves, by being, as it were, perpetually macerated in watery humours, lose

* *Vide* GREGORY, *Conspectus Medicinæ*, § 520.; GAUBIUS, *loc. cit.*

their natural elasticity, and become weak and flaccid ; whence a languid circulation, coldness, universal paleness, debility, cachexy, serous congestions, hydropical effusions, &c.

Some physicians have maintained, that our fluids could not possibly offend by too great a tenuity ; since thin juices pass with least impediment through the capillary vessels ; whence, it was supposed, “that this condition of the humours must be productive of the openest and readiest circulation of them.” Such persons do not appear to have rightly considered the healthy nature of our fluids ; for the blood of a strong and healthy subject, as we have before remarked, is a fluid of considerable density and thickness, by which, when withdrawn from the vessels, it is disposed immediately to run into a solid cohesive mass ; whereas, the blood, in weak and valetudinary subjects, has not such firmness of texture ; but is much thinner, and less easily disposed to a solid cohesion. From a consideration of this one single fact, they might have easily perceived, that the occurrence of a too thin state of the humours would render a

strong and healthy person in the condition of one who is weak and valetudinary. Moreover, since the red part of the blood, (which by the largeness of its globules is confined within the larger arteries and veins, and hinders them from collapsing,) in receiving the common impulse from the heart, by reason of the greater density of its parts, necessarily acquires a greater impetus or motion, which it communicates to the other humours, and assists in propelling them through the inferior order of vessels; and as the heart itself is more duly excited by the ponderous globules; therefore, when the blood becomes too thin and watery, or is deprived of its due proportion of globules, the action of the heart and arteries is impaired, the motion of the blood weakened, and the heat of the body proportionably lessened. Whence the watery liquors will not be easily exhaled from the body, but remain therein, and distend the vessels so as to give rise to serous congestions, or to be effused into the different cavities of the body, and thus produce a cachexy or dropsy. It is evident, therefore, that the animal humours may offend by a

too watery state, or by becoming preternaturally tenuous.*

The other species of morbid *tenuity*, which is indicative of a dissolved state of the blood, arises from want of a due pressure of the humours by the vital and elastic force of the vessels and viscera ; or it is of a compound nature, having an acrimony joined with the humours, by the attenuating power of which the globules and coagulable lymph are dissolved and broken down, and the crasis of the whole mass of blood so much injured as to prevent the mutual and necessary coherence of its parts.†

HEWSON has demonstrated, by some ingenious experiments, that the coagulable lymph of the blood may be so much attenuated as to dilute even the serum itself.‡ This dissolution of the animal fluids takes place from an acrimony varying greatly in its nature, either from the native oils and salts, resident in the body, being too much in quantity, or too largely evolved

* *Vide* VAN SWIETEN, Commentar. § 1174, &c.

† *Vide* GAUBIUS, Patholog. § 288. ; VAN SWIETEN, *loc. cit.*

‡ Experimental Inquiries, Exp. xviii. p. 49.

or corrupted ; or from some extraneous accession from meat, drink, medicines, poisons, miasmata, contagions.*

A resolution of the red particles, and an attenuation of the coagulable lymph, says a late celebrated physician, are effects which frequently occur in the system, though in different degrees. It is a temperament natural to some families ; and, when it is hereditary, may be greatly increased by external causes ; and even these causes of themselves are sufficient to induce the habit : such as a course of close, sultry weather ; a continued application of warm humid air to the body ; animal steams, where many persons are crowded together in small ill-ventilated apartments ; putrid exhalations ; the air of an hospital, where putrid ulcers, dysenteries, &c. prevail.†

This dissolved state of the blood is equivalent to what is denominated, by many eminent authors, the *putrid diathesis* ; and forms a habit

* GAUBIUS, *loc. cit.*

† WALKER, *An Inquiry into the Small Pox*, p. 120, 121.

of body extremely obnoxious to low, nervous, putrid fevers, and to the operation of contagious virus.

The general indications of this morbid temperament are, paleness of complexion, soft and relaxed fibres, aversion to motion, fatigue from the smallest exertions: persons of this constitution, too, are, on many occasions, liable to faint.*

Another vitiation of fluidity, to wit, a preternatural *spissitude*, or too great a viscosity, or thickness in the consistence of the blood, is a constitution or crasis directly opposite to tenuity, and supposes a deficiency of fluidity, which is no less various, and must be explained in order, according to its differences. If the thickness, or cohesion of the humours, arises from an excess of animal motion, or from a too violent circulation and great strength of vessels, it is then called an *inflammatory spissitude*, or more properly a *phlogistic disposition* of the humours: but when, from a defect of the animal motions, or from too languid a circulation, and weakness

* WALKER, An Inquiry into the Small Pox, p. 122.

of the vessels and viscera; from a loss of the fluids; or from feeding too plentifully upon such substances and kinds of aliments, as are of a glutinous and tenacious quality, or in themselves apt to run into such cohesions as cannot be easily separated by the vital powers, it has been then denominated a *glutinous* or *viscid lentor*; which is productive of that white swelling, or turgescence of body, that the ancient physicians have called the *leucophlegmacy*, (λευκοφλεγματια,) or *white phlegm*.*

In the latter vitiation, the blood is so far degenerated as to lose both its natural redness and density, to grow lighter, become more lax, and acquire almost a mucous nature. In this state of the blood, the coagulable lymph is not sufficiently participant of an animal nature; the red globules are too few in number, and those too loosely compacted; and the serum is more viscid or ropy than ordinary. In a word, the whole sanguineous mass becomes too gross,

* *Vide* VAN SWIETEN, Commentar. § 69 to 76. & 1174.

viscous, and inactive: and when, in this morbid state, the circulating fluid has been imprudently withdrawn from the vessels, a very little red concrete blood is found swimming in a large quantity of viscid glutinous serum.*

The phlogistic constitution of the blood, on the contrary, indicates a deficiency of serum, or rather a superabundance of crassamentum, which necessarily increases the density, firmness, and consistency of the whole mass of blood. The red globules are in too great quantity, and too closely compacted or condensed; the coagulable lymph is more highly animalized, and the serum more dense than ordinary; and thus the whole mass of blood, being rendered too dense and ponderous, is, in virtue thereof, proportionably more exciting to the heart and arteries, and, of consequence, is productive of a too active and vigorous circulation. This morbid quality is, sometimes, very evident to the senses, where the blood that is taken from some persons has very

* VAN SWIETEN, Commentar. § 72.

little serum separated from the coagulum, though it has stood a sufficient time for such separation: thus it commonly is in acute inflammatory or ardent fevers, and likewise in the beginning of some éruptive fevers.* It also appears, from the experiments of BROWNE LANGRISH,† that the blood is more thick, dense, and tenacious, or at least that the crassamentum abounds more, and the serum less in *quotidians* than in *tertians*, and in *tertians* than in *quartans*; and in all these the red globules bear a greater proportion than is consistent with health; but in *quotidians*, *ceteris paribus*, the blood comes nearest to an inflammatory state. Now, when the sanguineous globules are in great number and very dense, and the vessels themselves strong and elastic, a greater momentum of motion must be produced in the circulating fluids, and, of consequence, much heat, which both dissipates the more subtle and watery parts of the blood, and incrassates

* *Vide* LOBB, Practice of Physic, vol. i. lect. 3.; BROWNE LANGRISH, Modern Theory and Practice.

† *Ut antea*, chap. v.

the remainder, so that it becomes more firm and cohesive, and less fit to circulate through the *minima vascula*, or extreme capillary vessels.

The red particles and coagulable lymph have been justly considered, by physiologists, as the most active or inflammatory parts of the blood; and this quality they appear to derive principally from their greater density or weight, by which the action of the heart and arteries is more duly excited; and of consequence there is produced a greater impetus of the circulating fluids, with a proportionate augmentation of temperature; for whatever be the cause of the natural or vital heat, nothing is more plain, than that its increase and decrease are always, *ceteris paribus*, as the different velocities or projectile force of the blood. We may observe, that all persons readily have their temperature increased by labour, or exercise, which augments the motions of the blood; but persons in health, who have a due quantity of red particles in their blood, are sooner heated by exercise, than those who are infirm, and have a poor blood, or few sanguineous globules. And, indeed, in propor-

tion to the crassamentum in the blood, is the degree of heat in all animals. The experiments of SHEBBEARE demonstrate, that all animals, whose degree of heat is superior to the human, have a larger proportion of crassamentum in their blood, than mankind in health.* Is it not probable, therefore, that different proportions of red globules in the blood of persons in health may have some share in producing a difference of temperament ?

The signs of an inflammatory diathesis of the blood, are great strength of the fibres, a strong, firm pulse, much heat, and redness that is particularly observable in those places where the tender vessels are not covered with true skin; as in the lips, the gums, the tongue, the inside of the mouth, the nares, the corners of the eyes, the adnata, the inside of the eyelids, &c. But when the glutinous or viscid lentor predominates in the humours, there is paleness in all these parts; a weak and languid circulation, with coldness, sluggishness, and a laxity or doughy

* SHEBBEARE, Practice of Physic, vol. i. p. 248.

softness and intumescence of the whole body. Hence, in the beginning of a leucophlegmatic habit, persons, observing themselves grow more full and bloated, are deceived by this specious appearance, and are often pleased to think they are perfectly well, and growing fat.

In general, persons of vigorous, robust constitutions, of strong, rigid fibres, who take much exercise, and a full diet, are peculiarly subject to a rich, dense, inflammatory blood, which necessarily increases the phlogistic diathesis of body, and renders it constantly liable to acute ardent fevers, and inflammations; on the accession of which there will be produced the most violent symptoms, which will quickly prove fatal except when prevented by timely bleeding, cooling, diluting, emollient drinks and medicines. The other condition of the circulating fluid, on the contrary, is common to persons of a relaxed habit of body, or those in whom the solids have lost their due force and elasticity; for whenever this happens, the parts of the blood, being less agitated, cannot but thereby the more attract one another, and in this case cohere in too

viscous a manner; nor can the action of the vessels divide the juices so minutely as is required for their circulating through the very small passages of the *minima vascula* or capillary vessels. From the viscid or slimy lentor, therefore, obstructing the small vessels, and preventing the due motion of the humours through them, there necessarily follows an imperfect or disordered state of all the concoctions, circulations, secretions, excretions, and all the vital, natural, and animal motions.* Hence, universal indigestion, weakness, coldness, paleness, cacochymy, leucophlegmatic and dropsical disorders, glandular obstructions, and fevers of the low and slow nervous kind. In this state, too, the blood having lost its most vital principles, and at the same time being too slowly moved, at length, for want of due motion and circulation, falls into a spontaneous corruption, productive, at last, of such a degree of acrimony or putrescency, as not only to corrode and destroy the contexture of the

* BOERHAAVE, Aphor. de cognosc. et curand. Morbis, 72,

more delicate solids, but sometimes to end in fevers of a dangerous, putrid, malignant nature.*

It will appear from what has already been said, that these two different states of the fluids may not improperly, to a certain degree, be considered as constitutional, for they naturally follow the respective state of the solids; so that a strong, rich, inflammatory blood always attends a strong, elastic set of vessels; and a gross, viscous, or weak blood, a relaxed habit of body, or a weak state of the vessels and viscera; but where either considerably deviates from the standard of nature, it becomes a real vitiation, and, as such, is to be duly regarded in the treatment of any concurring disease.

As the several states or conditions of blood, which have now been described, may arise from various causes, and be also complicated with different habits of body, it is obvious that, as it respects their curative indication, nothing in general can be here determined; but we must care-

* *Vide* HUXHAM, Essay on Fevers.

fully endeavour to ascertain the nature of the morbid quality in the humours, and also the cause from which it proceeds, a right apprehension of which frequently leads to the proper correction.* For example, if the humours are too thin and aqueous, from an abuse of watery things, the cure will be effected by a dry regimen and diet, and by giving strength to the over-relaxed vessels; but if they are dissolved by acrimony, or some contagious miasmata, the indication is to correct and weaken the same by plenty of watery and emollient drinks. Again, where there is an inflammatory disposition of the blood, the vessels are to be relaxed, that they may the less compress their contained humours; but when a viscid lentor and thickness prevail, the strength of the vessels is to be increased, that they may the more duly actuate the contained humours, and work them up to a healthy texture and consistence.†

* Et causæ quoque estimatio sæpe morbum solvit. CELSUS
In Præfat, lib. i. p. 16.

† VAN SWIETEN, *Commentar.* § 1174.

Physicians have described another vitiation of fluidity, in which the blood is supposed to lose its natural mildness and fluxility, and to grow preternaturally thick, black, and viscid ; so as to be less fit for its different motions, and the uses of life. It consists, therefore, in both a morbid spissitude and viscosity. Now the ancients, as may be learned in ARETÆUS,* actually observed such a degeneration of the blood in melancholic persons ; which is, likewise, confirmed by the observations of modern physicians.†

The causes of this morbid quality of the blood and humours, may be every thing that expels the watery and more moveable parts of our juices ; and has a tendency to fix the rest : of consequence, it has for its *matter* the thick oil and earth, or the more gross and more tenacious parts of the blood united and compacted together.‡

Now if the entire mass of blood be in any way exhausted of its succulent, and more moveable

* De Curat. Morb. Diurn. lib. i. cap. 5.

† *Vide* HOFFMAN, Medicin. Rational. System. tom. iv. p. 201 ; MEAD, Medical Works, p. 372. 424.

‡ BOERHAAVE, Aphor. 1093. 1095.

parts, it necessarily follows, that the thick and less fluxile will then be left in closer cohesion; whereupon, the common circulating mass, despoiled of its limpid vehicle, assumes a more tenacious and immovable disposition, by which its circulation through the smaller vessels will be rendered more difficult; while, at the same time, the said blood itself will be less mild than natural, or, at least, more apt to degenerate into an acrid state, in consequence of any given quantity thereof containing proportionably a greater stock of animal salts and oils.

The refinement of modern investigators has added to the consideration of the animal fluids a new source of disease, supposed to be connected with those changes which depend on the composition of our fluids; that is, their relation with different proportions of oxygen, nitrogen, carbon, and hydrogen. But as this subject has not yet received, from the pathologist, a share of public attention, it may, in this place, be passed over without any further notice.

This finishes morbid fluidity, or the consideration of those simple affections of the blood de-

pending upon some change or difference in the state of its natural cohesion and consistence: which change, it has been shown, may arise either from some variation in the proportion of the discordant parts of which the blood consists, or from some default in the texture of this fluid.

Now, as the state of the fluids, in the body, appears in general to depend chiefly and especially on that of the solids, it will, no doubt, by some, be urged, that to the consideration of the former we have attached more importance than they in reality merit; it being seldom that we can fairly and immediately deduce morbid symptoms from the state of the fluids alone. In reply to this, it will suffice to observe, that in describing the various morbid constitutions of the animal fluids, and their effects upon the body, we have represented them such as they may generally be supposed to be in their full extent, and when influenced by circumstances favourable to their operation: not that the same effects may not proceed from other causes, or in general be traced with more certainty to other circumstances of the con-

stitution more fundamental, and more powerful in determining its condition. It was on a former occasion remarked, that such is the limits of health, that every deviation from the sound state is not disease; though probably each may be supposed to form a predisposition to disease. Thus with the blood itself: every deviation from the natural standard does not necessarily become an immediate cause of disease; but still, each may render the animal body more obnoxious to the influence of morbid causes in general; and by concurring with the solids themselves, on many occasions produce disorders in the constitution, which would not otherwise have taken place. It is certain, *ceteris paribus*, that a poor, watery blood will produce effects upon the constitution different from those arising from an inflammatory blood, or such as abounds too much in red particles. This latter, on account of its greater density and weight, will more duly excite the heart and arteries, produce a higher degree of the vital heat and motions, and in this manner predispose the body to ardent and inflammatory fevers, or all diseases

of increased circulation and heat : whereas, blood of the former character, from containing too small a quantity of red particles, or being less dense and ponderous than natural, will be less exciting to the heart, and of consequence be attended with a lower state of the vital heat and motions. The solids themselves, too, from being perpetually loaded with these watery humours, will lose much of their natural cohesion and elasticity, and become weak and flaccid.

To conclude : although the consideration of the state of the solids, or rather the consideration of the motions and moving powers of the animal system ought, doubtless, to form the leading inquiry in distinguishing the different states of the body both in health and sickness ; yet it must also be acknowledged, that the state and various condition of the animal fluids have some share in this respect ; and, of consequence, are not to be entirely neglected by the pathologist.

Morbid Acrimonies of the Blood.

WHEN we consider the fluids as they are in the human body when sound, says a learned writer,* it is evident, that they are not fitted by fluidity alone for answering the ends required; but that other properties are requisite, and these are either common to all, or proper to single ones, by which they both differ from other liquors not of the human body, and from one another.

The most common characteristic quality of our healthy circulating fluids is the mild or bland; directly opposite to which, is the vitiation of *acrimony*, as it is called, which appears to have been much too frequently and too rashly accused as the cause of many diseases. Nature has been solicitously careful to guard against the admission of such a pernicious quality in our humours; for she has not only taken various precautions to prevent acrid materials from reaching the com-

* GAUBIUS, Patholog. § 289.

mon mass of blood, but further, even after having entered the circulation, they are frequently rendered inert by being largely diluted with a considerable portion of the circulating fluids, and probably sheathed by the mucilaginous, or *albuminous* portion of the blood; or else by stimulating the secretory and excretory organs to a larger secretion, they are eliminated, before they have time to hurt, together with the saline, putrescent, and other degenerated and degenerating parts that are continually passing off by the several excretions. There are, however, some evidences of the operation of a morbid acrimony. The subject must therefore be inquired into.

The term *acrimony*, as applied to the human body, includes all those noxious and morbid matters, which, being mixed with the blood, either destroy its healthy crasis, stimulate the living solids, or corrode the inert.*

Pathologists have divided acrids into *mechanical* and *chemical*, but in this place it will be ne-

* MACBRIDE, Theory and Practice of Physic, p. 85.

cessary to consider, particularly, the latter only ; since it alone, as GAUBIUS remarks, may so infect the fluids as to constitute a part of them.

The sources of a morbid acrimony are either *internal*, and derived from the spontaneous degeneration of the humours themselves ; or *external*, and situated in the perpetual intercourse which the living human body holds with various external things ; and thus the air, meat, drink, condiments, medicines, poisons, miasmata, and contagions, may introduce different acrimonies into the fluids in different ways, which being there evolved and corrupted by heat and motion, or excited into action by the vital power, induce itchings, pains, erosions, various kinds of eruptions, with irregularities in the animal motions, spasms, and many other perturbations of the functions. It is one of the laws of acrimony to act, or become more injurious to the body, in proportion as it is moved. Hence scorbutic persons are rendered most sensible of their pains upon motion or exercise of any kind ;

which accords with the well-known axiom, *acria nulla agunt, si non moveantur*.*

The principle sources of acrimony next merit consideration.

The various kinds of food or alimentary substances, which have been accused of introducing an acrimony into the *primæ viæ*, and afterwards into the fluids, do, no doubt, many of them produce such an effect; but there are also, probably, many others which have little influence in this respect. An acid in the stomach produced from a vegetable diet, or the continued use of acids and acescent things, which cannot be subdued by the powers of the body, certainly injures the digestion, and produces, in consequence, debility; but it perhaps rarely, if ever, enters so largely into the circulation as to taint the mass of blood. There is no trace of an acid in this humour, nor even in the secreted fluids, if we except the ureal and arthritic concretions, and of these, the latter only can be obscurely traced to a vegetable, or acescent aliment. An

* DE GORTER, Tract. de Perspir. cap. vii. § 3.

acid, indeed, is foreign to the body ; for no animal humour, properly so called, ever appears to become acid of itself. Should an acid acrimony, therefore, ever actually be discovered to take place in the blood, its origin would seem to be owing to the aliments not being sufficiently changed by the vital powers.

An alkaliescent diet is not frequent. The aliments derived from the animal kingdom, however, approach much nearer to this character than those from the vegetable.

Animal substances are almost all of an alkaliescent, or, perhaps, rather a putrescent nature. They greatly abound in salts and subtle oils. An excess of animal food, therefore, by conveying into the system, large quantities of saline and other active particles, is thought to inflame the juices, produce an alkaline disposition of the blood, and strongly incline it to putrefaction.*

* A person that lives on nothing but mere water, and flesh or fish, without any thing either acid or acescent, soon contracts a very great rankness in all his humours ; he grows feverish, and at length his blood runs into a state of putrefaction. HUXHAM, *Dissertation on the Ulcerous Sore-Throat*, p. 304.

The experiments of Dr. YOUNG show the influence of animal food in giving an *alkalescency* to the animal fluids, and also the necessity of a due proportion of vegetable aliment, or acescents, to correct this tendency in the humours. These experiments inform us, that by feeding a bitch on animal food alone, she “afforded a milk acescent and spontaneously coagulating, like that of ruminating animals; whereas the same bitch, for a little time fed entirely with animal food, afforded a milk manifestly alkaline, and not spontaneously coagulating.”* Such animals as feed upon other animals are well known to have their juices easily disposed to become alkaline;† their flesh is rank and unsavoury.‡ All those creatures which live upon prey have constantly a strong and fetid breath.§

Now a putrescency, or as Dr. CULLEN expresses it, “an alkalescency, is the peculiar ten-

* *Vide* CULLEN, Mat. Med. vol. i.

† BOERHAAVE, Aphor. 97.

‡ *Vide* HUNTER, Animal Economy.

§ VAN SWIETEN, Commentar.

dency of the animal economy ;”* which will be more easily understood from a consideration of the nature and generation of what are called the *animal salts* ; into which is converted a considerable portion of almost every thing ingested.† Even the strongest vegetable acids are by the vital powers converted into a *neutral*, or a sort of *ammoniacal salts*, which, in proportion to the time they are exposed to the action of the vessels, and the heat of the body, are rendered more and more subtle, approach nearer and nearer to an alkaline nature, and would at length become actually alkaline, were they not diluted, washed off, and corrected by acescent drink and diet.‡ If the aliment, then, be chiefly of the alkalescent kind, as most animal substances appear to be, it will conspire with the action of the body, and of consequence greatly increase this natural tendency of the fluids. Experience, indeed, shows that no person is able long to support a

* *Materia Medica*, vol. i. p. 218.

† GREGORY, *Conspectus Medicinæ*, § 529.

‡ HUXHAM, *ut supra*.

diet of flesh and fish alone, unless corrected by a proper proportion of vegetables, or of acids and acescent things. A confinement to animal food, with abstinence from recent vegetables, is generally admitted to be among the principal causes of scurvy. Upon the first establishment of the New-York State Prison, about 1797, before a regular system of internal management with regard to the diet of the house was adopted, an alarming scorbutic disorder made its appearance among the greater part of the prisoners in that institution. They had been confined for some time to a diet almost exclusively of animal provisions; and without adverting to the source of the complaint with which they became affected, a variety of means was employed for its removal, but, as might have been anticipated, without effect. At the suggestion of Dr. Hosack, who shortly after this period was appointed the physician to the establishment, the liberal use of recent vegetables was enjoined as indispensably necessary in order to check the progress of the disease, and for the purpose of restoring the health of the prisoners. The learned and experienced

Dr. FERRIAR* found that many of his diabetic patients were rendered scorbutic, by a strict adherence to the exclusive use of animal food. Instances of a similar kind have fallen under the notice of Dr. HOSACK.† The scurvy, it is well known, is much more frequent, and, indeed, almost epidemic, in cold and northern climates, where, from a scarcity of vegetables, the inhabitants are obliged to live principally upon flesh and fish. The diet of the Icelanders, which consists almost exclusively of animal matter, is universally productive of a train of obstinate cutaneous and scorbutic affections, which have been lately noticed by Dr. HOLLAND.‡ The learned Dr. LIND§ has, on this subject, furnished us with a very remarkable story from SINOPÆUS.|| “There are whole nations in *Tartary* who live altogether on milk and flesh. These people are never seized with the small

* Medical Histories and Reflections, vol. iv.

† MS. Notes on the Theory and Practice of Physic.

‡ *Vide Eclectic Repertory of Philadelphia*, vol. iii.

§ On Scurvy, p. 300.

|| *Parerga Medica*, p. 311.

pox ; but, on the other hand, are subject to violent scurvies, which at times sweep off as great numbers as the small pox does of other nations.”

A mixture of vegetable substances with our food, therefore, seems requisite towards the generation of good chyle, and to correct the continual alkaline and putrescent tendency of the animal fluids. The proportion of these, however, will depend greatly on circumstances. The inhabitants of very cold countries, as Greenland, Lapland, and Hudson’s Bay, can sustain a diet of flesh and fish, with much less impunity than those who reside within the tropics, or in hot countries, where the septic tendency of body is much greater ; of consequence they are obliged to be much more abstemious of animal food, and live more on vegetable and antiseptic materials.

All animal diet is more apt to excite and heat the body than vegetable ; and the reason is obvious : The salts of animals are chiefly volatile and alkalescent ; but those of most vegetables are of a fixed nature and acescent ; and on this

account, when received into the blood, remain inactive and quiescent without much exciting the system: whereas the former, which are naturally active and somewhat volatile, and are rendered still more so by the heat of the body, not only excite a greater agitation in the fluids, but likewise irritate the solids, and stimulate the several series of vessels into quicker and more forcible vibrations. An excess of animal food, therefore, without a due proportion of vegetables and acescent things, must needs prove unsuitable or incongruous to the constitution, and not only lead to scurvies and various kinds of eruptions, but also predispose the body to ardent inflammatory diseases, and to putrid, malignant, and pestilential disorders, &c.

With respect to acrid matters introduced into the body from without, many of them have long been suspected of being prejudicial to health. *Acrida ingesta*, says DE GORTER, si tam rigida sint, ut vi vitæ superari nequeant, venena nobis sunt: quæ verò deficiente subiguntur longas pertinacissimasque ægritudines et dolores inferre solent: mitiora vero quandoque maximè appe-

tuntur, exhibentia, grata stimulantia. Talia sunt innumerabilia in usu humano, ut acida, salina, aromatica, alcalica, &c. quæ omnia, si non nimis vehementia sunt, in corporibus robustis facile vincuntur; sed in debilibus diu sæpe latere possunt, maximè si simul eorum causam morbificam foveant: quæ vero huic causæ contraria sunt, medicamenti titulo adhiberi possunt.*

The body, however, is in some measure protected against the admission of any thing of a heterogeneous nature, by the power of sensation, which, being readily excited into action by the irritation of any acrimony impressed, so constricts the mouths or orifices of the lacteals as to exclude many offending matters, except when so diluted and blunted as to become mild.† But this power is by no means absolute; nor do the lacteals possess that peculiar appetency, or discriminating faculty, for which some have contended: on the contrary, there are innumerable evidences that foreign matters can be conveyed into the blood

* DE GORTER, Tract. de Perspir. cap. vii. § 11.

† GAUBIUS, Patholog. § 297.

in their active state.* “A great many substances may enter the lacteals along with the chyle, even solids reduced to a fine powder.”† Solutions of *indigo* and *blue-stone* are readily absorbed by the lacteals of a dog.‡ The lacteals and lymphatics, says Mr. CRUIKSHANK, take up the most irritating and stimulating substances.§

Pathologists have insisted much on the injuries resulting from an immoderate use of the *aromatics*. But the circumstances of their operation are not, perhaps, clearly determined. We have reason, however, to suspect their noxious influence in those affections of the bladder, which, in advanced life, are connected with a tenderness or preternatural sensibility of its neck, or perhaps some affection of the prostate gland. *Common salt* is generally supposed to be the most innocent of the whole class of acrids, and

* *Vide* SMITH, Inaug. Dissert. on Absorption, in CALDWELL'S Collection of Theses, vol. 1. *Philadelphia*.

† FORDYCE on Digestion.

‡ *Vide* Dr. MUSGRAVE'S Experiments, in Philos. Trans. Abridg. vol. v.

§ Anatomy of the Absorbing Vessels. p. 123.

indeed would seem to be a necessary stimulus to the process of digestion. But even this agreeable condiment, if too much accumulated in the habit, and particularly of such as are of a tender constitution, is capable of producing the most pernicious effects, as will clearly appear from the following remarkable case recorded by the late Dr. PERCIVAL.

“ A young lady aged sixteen, tall, thin, and of a delicate constitution, though in tolerable good health, was advised to use sea water, on account of a strumous swelling and inflammation of her upper lip. She drank a pint of it every morning for ten days successively, which did not pass off freely by the usual evacuations. At the end of this period, she was suddenly seized with a large discharge of the catamenia ; was perpetually spitting blood from the gums, and had innumerable petechial spots on different parts of her body. Her pulse was quick, though full, her face pale and somewhat bloated ; her flesh somewhat tender ; she was often faint, but soon recovered her spirits. The flux from the uterus at length abated, but that from the gums increased to such

a degree, that her apothecary took a little blood from her arm. From the orifice blood continually oozed for several days. At last an hemorrhage from the nose came on, attended with frequent faintings, in which she at length expired, choaked, as it were, with her own blood. Before she died her right arm was mortified from the elbow to the wrist. And it is further to be remarked, that though blood let from her some weeks before she began the use of the sea water was sufficiently dense, yet that drawn in her last sickness was putrid and dissolved gore.”*

Physicians have frequently had occasion to complain of the bad effects of the *alkaline* salts both fixed and volatile, and, indeed, there are many indubitable and well-attested facts of their having produced in the human body putrid symptoms of various kinds.† Such effects have been particularly observed to follow the too free use of Mrs. STEPHENS’S famous alkaline medicine. HALLER observes of this medicine,

* PERCIVAL, Essays, Medical and Experimental, vol. ii.

† Vide HUXHAM, Essay on Fevers, &c.

that by long use it renders the blood alkaline and acrid, and brings on scorbutic and hectic symptoms.* As these salts are found to resist the putrefaction† of dead animal matter, it might appear a little surprising that they should be capable of producing putrid effects in the animated machine; but the difficulty will in a great measure vanish when we consider, that they not only promote the dissolution, and, consequently, the putrefaction of the blood; but further by their stimulating properties they create an excess of heat and motion, which according to HALLER,‡ are among the principal causes of putridity in the animal economy.

An acrimony is likewise generated when the body, in a sound state, is not duly supplied with the necessary nourishment; and that the sooner in proportion as the vital power is stronger.

* Sed in vivente etiam homine lixivi sales, qui Stephaniano medicamento efficaciam præstant, longo usu sanguinem alcalinum, acrem, scorbuticum, hecticumque reddiderunt; ut etiam vesicas de cute elevaverit. HALLER, Elem. Physiol. tom. ii. p. 90.

† PRINGLE, Diseases of the Army, Append.

‡ Vide Elem. Physiol. tom. ii. p. 80.

The animal humours, in consequence of continual heat and motion, naturally and constantly tend to a state of acrimony and putrefaction. One of the principal means employed by nature to obviate this dangerous tendency is the regular and daily supply which the system receives of fresh and nutritious aliment. For the office of the chyle is not only to afford nutriment to the different parts of the body, but also to temperate, dilute, and correct the blood itself. When, therefore, the blood is for some time deprived of the necessary refreshment of this demulcent liquor, it naturally grows more acrid and putrescent; to such a degree at least, as will be sufficient to render the whole mass, in a few days, unfit for any of the functions of life. In a person who has suffered hunger for a long time the blood and humours are attenuated and rendered more acrimonious, by which they incline to putrefaction; and hence, all the secretions are rendered acrid and putrescent: what is expired from the lungs becomes so very fetid and disagreeable that the person is scarcely able

to endure his own breath.* Those who die of famine have their blood and all the humours first rendered highly acrimonious,† which not only corrodes the delicate vessels, and sometimes induces hemorrhages and effusions of blood in different parts of the body, but so injures or almost destroys the tender fabric of the brain and cerebellum, as to produce intolerable pains, spasms, convulsions, acute fevers, attended with raging fury, and at length death itself.‡

* Illis qui in ediam patiuntur, et quorum sanguis novo affluente chylo non reficitur, sanguis per se interno calore dissolvitur et putrescit, hincque omnia, ex eo sanguine secreta, fœtent et acria sunt, halitus olet, saliva labia et linguam rodit, sudor ingratus est, bilis et cætera secreta irritant, et ipsas partes solidas, in quibus hospitantur, destruunt; nisi enim opportune novo affluente latice chyloso restaurentur, totum corrui. SCHWENKE, *Hematolog.* p. 131.

† The blood of those who die of famine becomes highly acrimonious, which begets fever, phrensy, and such a degree of putrefaction, as is utterly destructive of the vital principles. HUXHAM, *ut antea*.

‡ Ostendimus, etiam modico a jejuniio fœtere animam, etiam in purissimo feminae corpore. Sic lac continuo rancescit, et urinæ intoleranda fit acrimonia. Sed diutius si inedia protracta fuerit, ab erosione ut videtur nervis, dolores non tolerandi nascun-

The use of hard and indigestible aliments, or such as are too tough for the individual constitution, and insuperable to the powers of the body, will, in like manner, favour the generation of acrimony; for it is easy to understand that the chyle, which is drawn from food of this character, will not only be less fit for nourishing the body, but also deficient in those qualities which are requisite to dilute and correct the acrimonious and putrescent animal humours. Hence, crudities and spontaneous corruptions from a want of proper chyle and nourishment. But moreover, this crude chyle not being either duly elaborated or expelled the body, must necessarily of itself, by the heat of the blood, by repeated circulations, and continuing long there, become acrid and putrescent, together with the other juices of the body. It is to this source

tur, et vasa rumpuntur, ut hæmorrhagiæ narium superveniant, et sanguis in ventriculum avicularum effusus visus sit, inque intestina. Celeriter etiam mens emovetur, et merositas primo atque mentis pene alienatio, et epilepsia, inde demum, delirium, deinde plenus furor superveniat, mortemque fere præcedat. HALLER, *Elem. Physiol.* tom. vi. p. 167.

that the learned and practical Dr. LIND, in his excellent book on Scurvy, has principally attributed the production of this disease, so far as a sea diet is concerned in it. The scurvy, however, is not peculiar to seamen or navigators. There are instances of its appearance in besieged towns. It occurs in low, damp situations, under the use of unalimentary food, or where the diet has been deficient in quantity, or of a low quality. Hence it is sometimes observed in the train of famine : such was the case in Paris, and other parts of France, in the year, 1699.* In two recorded instances this complaint occurred, in the most inveterate degree, in two old women who had subsisted, for more than three months, on nothing but bread and an infusion of tea, without any other ingredient whatever in their diet.†

It is probably in this way, too, that bad and unwholesome food, ill ripened fruits of the earth, &c. do not unfrequently produce malignant and pestilential diseases : for the juices,

* BLANE, Diseases of Seamen, p. 191.

† MILMAN, Inquiry into the Scurvy and Putrid Fevers, p. 25.

with which such supply the blood, being corrupted, must necessarily form a fluid unfit both for nutrition and the animal secretions. Hence it is, that famine is not unfrequently succeeded by pestilence, agreeably to the proverb, *λοιμὸς μετὰ λιμῶν.*

The blandness of our fluids is likewise destroyed both by an excess of motion, and by a want of motion in them; and thus the same effect will be produced, by two directly opposite causes.

But nothing, perhaps, more favours the generation of acrimony in the body, than the irregularities of those operations by which secretion and excretion are effected. The continual exercise of the animal functions produces, in the human body, an acrimony which is dissolved in the serosity of the blood, and is usually covered by bland nutriment continually supplied until carried off by the fluids denominated, for this reason, *excrementitious*. If, however, the secretion or excretion of these noxious materials be prevented by any cause, so that they be retained in the animal economy, an acrimonious state of

the fluids necessarily follows. What this acrimony is, we do not perhaps clearly and exactly know. It appears, however, to be partly of a *saline*, or, rather an *alkalescent* nature, and very probably contains some considerable admixture of *septic* particles.

The generation of this acrimony in the fluids is much facilitated by an increase of heat and motion. Hence it goes on much more rapidly in fevers: and the changes then wrought upon the humours are rendered more conspicuous. It is certain, that the urine is always rendered more strong, fetid, and acrimonious, in proportion to the violence or rapidity of the circulation. In weak persons unaccustomed to exercise, it is limpid, pale, without smell, and not very salt to the taste; but in a strong person, whose body is exercised by labour or motion, it is more red and fetid, and very saline. "If, therefore, the motion of the blood through the vessels be increased, it will make the salts of the blood to become more acrid and volatile; the oils also will grow thinner, and be less mild; these, again, will form a fresh stimulus to increase the circu-

lation, from the increase whereof they deduced their origin, and the effect of a disease will increase the disease itself.”*

An acute and ardent fever is capable in a few days of so changing the texture of the blood, and corrupting the state of the humours, as to strongly incline them to a putrid and alkaline disposition. The blood, indeed, can never be so far corrupted as actually to become alkaline, whilst circulating in the vessels of the living body; for death itself would first be produced by the destruction occasioned to the very small vessels, and the delicate contexture of the *cerebrum* and *cerebellum*. It may be questioned whether even the urine itself, which is the true lixivium of the blood, has ever been found to become actually alkaline, even in the most ardent, or most putrid fever; except, perhaps, where it has been a very considerable time in the bladder before discharged. Still, however, the blood and humours may become so far *alkalescent*, that is, tend so strongly to an alkaline state,

* VAN SWIETEN, Commentar. § 100.

as to render them unfit for the purposes of life and health. This tendency to an alkaline condition ought not to be confounded with that which is really alkaline.

Nature has instituted two principal evacuations by which the blood is freed from these noxious and excrementitious parts. These are *urine*, and *insensible perspiration* both cutaneous and pulmonary.

The urine is a sort of aqueous lixivium, or the ablution of all the oils and salts of the blood, that were rendered too acrid to be retained with impunity in the circulation. It is of all our liquors the most easily putrescent,* and consists of a water containing salts and oils approaching to a state of putrefaction.† The urinary passages, therefore, are destined to carry off and cleanse the blood from those noxious, acrimonious, and putrescent matters which, if retained by any cause, would be productive of the most dangerous or fatal effects. The acrimony thus induced, being increased by the heat

* RICHERAND, Elements of Physiology, p. 94.

† BOERHAAVE, Elem. Chem. tom. ii. proc. 100. &c.

of the body and the action of the vital parts every moment, would soon become intolerable to the more delicate vessels, and dissolving to the humours, by a urinous and most pernicious quality. It soon shows itself in its effects on the tender vessels of the brain and cerebellum; for which reason those who die of a suppression of urine, have all the functions of the brain first disordered: they usually become comatose, delirious, are sometimes convulsed before death, but more generally go off quietly in a fatal sleep.* “A sufficient attention,” says an eminent physiologist of the present day, “has not hitherto been given to the symptoms of a *urinous fever*, or affection occasioned by a too long retention of this liquid in the cavity of the bladder. I have frequently had occasion to observe, that no disease gave better marked signs of what physicians call putridity. The urinous and ammoniacal odour exhaled from the whole body in sickness, the yellow, greasy moisture covering the skin, the great

* VAN SWIETEN, Commentar.

thirst, the dryness and redness of the tongue and throat, the frequency and irritation of the pulse, joined to the flaccidity of the cellular membrane; all indicate that the animal substance is menaced with speedy and prompt decomposition.”*

The urine is likewise a humour interesting to the physician on many other accounts. The characters exhibited by this fluid are sometimes of considerable importance in distinguishing the nature and various states of any disorder. To those, too, who know how to form a judgment upon its properties and appearances, it is not unfrequently of assistance in deducing satisfactory indications of practice. A proper knowledge of the nature of the principles which it carries off in certain circumstances, affords much information respecting the disposition of the constitution and the predominant principles in the fluids of the human body.

But the most considerable, perhaps, of all the evacuations from the human body, is the *matter*

* RICHERAND, Elements of Physiology, p. 95.

of perspiration; the constant and equable discharge of which appears scarcely less necessary to life and health, than that of the urine itself. Its importance, too, rests not merely on its freeing the blood from noxious or *excrementitious* matters; but it is further useful in maintaining a due equilibrium between the solids and fluids of the system; in preserving the skin in a proper state of softness and pliability; and, lastly, in being one of the great and principal means employed by nature to diminish the effects of increased excitement, by carrying off the superfluous animal heat, and thereby moderating the temperature of the body, and preventing the individual from receiving a degree of heat superior to what is fixed by nature.

It is owing principally to this latter circumstance that animals can for some time endure without injury a temperature much higher than could have been supposed. The experiments of TILLET, of FORDYCE and his associates, and of others, are well known.* By these experi-

* *Vide* REES' Cyclopædia, art. Heat; also, Phil. Trans.

ments we learn, that persons have for a considerable time remained in an atmosphere heated to a temperature exceeding the boiling point of water. Nature has in this respect most amply displayed that system of general liberty, which she appears to have been so desirous of establishing in every thing relating to the animal machine. If the causes by which man is affected are various, his resources are equally multiplied: his temperature is adapted both for motion and repose; he lives equally in all temperatures and in all climates. When in a cold medium his perspiration is diminished, and there is of consequence a less expenditure of animal heat; the density of the air, too, being greater, it has a more considerable contact with the blood in the lungs; whence more air is decomposed, and the evolution of caloric proportionably increased, which repairs the expenditures occasioned by external cold. On the contrary, when he finds himself in a hot climate, where the air is more rare, and has of consequence less contact with the blood in the lungs, less of it is decomposed, less caloric is

disengaged, and from the establishment of a more abundant perspiration, a proportionably greater quantity of heat is carried off by the continual evaporation from the surface. Hence it is, that the natural temperature of the living human body is nearly the same in all climates and at all seasons of the year. But to return :

That a moist vapour is continually exhaling from the surface of the body, is evident from a variety of circumstances. When from any cause the quantity of this perspired vapour is so much increased as to appear on the surface condensed into a liquid or sensible form, it is then denominated *sweat*. But when it passes off in an invisible state, it is generally called *insensible*, or sometimes *Sanctorian perspiration*, in honour of SANCTORIUS. It would seem, however, to have been well known to HIPPOCRATES, who, in a few words, observes, that the whole body both exhales and inhales : “ἐκπνοον καὶ εἰσπνοον ὅλον το σῶμα.”*

Many experiments have been made for the purpose of ascertaining the quantity of matter

* HIPPOCRATES, De Morb. Vulg. lib. vi. sect. vi.

perspired by the human body. The first who made any estimate of this considerable discharge was the celebrated SANCTORIUS,* who continued his observations for no less than thirty years. A similar set of experiments was afterwards made by DODART,† in France, by KEIL,‡ in England, by the learned DE GORTER,§ in Holland, by ROBINSON|| and RYE,¶ in Ireland, and by LINING,** in South Carolina. On this subject, too, we have the still more recent and interesting experiments of CRUIKSHANK,†† HOME,‡‡ ABERNETHY,§§ and others.

The quantity of matter perspired appears to differ very considerably according to circum-

* *Medicina Statica.*

† HALLER, *Elem. Physiol.* tom. v.

‡ *Medicina Statica Britannica.*

§ *Tract. de Perspir. Insensib.*

|| *Treatise of the Animal Economy.*

¶ *Med. Stat. Hybern. in ROGERS on Epidemics.*

** *Philosophical Transactions.*

†† *On Insensible Perspiration.*

‡‡ *Medical Facts and Experiments.*

§§ *Surgical and Physiological Essays.*

stances. In the climate of Italy, SANCTORIUS* ascertained it to be equal to five eighths of all the meat and drink taken into the body. It is unquestionably one of the most copious of the natural evacuations; “and though it is sometimes in greater or lesser quantity, as influenced by various causes, yet it can never be partially suppressed long, much less can it be entirely obstructed, without the greatest detriment to health. For should its defect for a short time be supplied by some more copious and increased evacuation, as it sometimes is by that of the urine; yet, towards perfect health, the integrity of all the animal functions, more especially the natural evacuations, are requisite: there being somewhat thrown out of the body by each, which cannot so conveniently pass another way;”† and, as SANCTORIUS very justly remarks of any other evacuation substituted for this, “*illa tollit copiam, sed relinquit malam*

* Si cibus et potus unius diei sit ponderis octo librarum, transpiratio insensibilis ascendere solet ad quinque libras circiter. *Aphor.* 6.

† LIND, on Scurvy, p. 275.

qualitatem;”* it diminishes the quantity, but leaves behind it the ill quality.

The matter of perspiration is of two kinds, the *aëriform* and the *aqueous*. The former, which is small in quantity compared with the latter, consists of two different gases, to wit, the carbonic and the azotic.† The principles of the *aqueous perspiration* are, perhaps, nearly allied to those of the urine, only the former usually abounds more in a sort of oleaginous matter, from being thrown off from the blood after it has undergone a longer and much more elaborate action of the vessels, and when its principles are more thoroughly incorporated.

But whatever may be the chemical analysis of the perspirable matter, it is evidently destined for excretion. As the health of the human body greatly depends upon the due and regular separation and expulsion of excrementitious matters, so the constant and equable discharge of the perspirable materials must be of the first import-

* Aphor. 19.

† ABERNETHY, *loc. cit.*

ance, as it regards the healthy state of the body ; for being a production of the last and most elaborate scene of animal digestion, the blood is hereby freed of what is consequently the most subtle and putrescent of the animal fluids. And it is certain that the perspirable humours, when retained long in the body, are capable of acquiring the most noxious qualities, and even putrefaction itself;* becoming highly acrimonious, which is increased every moment by the action of the vital parts. Hence arise various morbid affections, according to the habit of body, the constitution of the individual, and the influence and determination of other causes.

Of the noxious qualities of the matter of perspiration, there can scarcely be more strong and positive proofs than those afforded by the experiments of Dr. ALEXANDER. By these it is rendered evident that both the *pulmonary*† and *cutaneous*‡ exhalations of the human body, even

* SANCTORIUS, Aphor. 43. 46. 149. 176. &c.

† ALEXANDER, Experimental Essays, p. 53.

‡ Ibid. Experimental Inquiry, cap. iii.

in the most healthful, are constantly replete with *septic* particles.

It is owing principally and especially to this circumstance, that the air is frequently rendered so poisonous and corrupt in jails and all other confined and ill ventilated apartments, where a multitude of persons are closely shut up together, and constantly and repeatedly breathing the same air; whereby the whole atmosphere of the place soon becomes an accumulation of highly septic miasmata, which being rendered more active and virulent by heat and stagnation, at length assume a putrefactive contagion capable of producing the most malignant disorders. Hence it is, that air, often expired and replete with animal steams or exhalations, is, of all others, the strongest predisposing cause of putrefaction. The malignant and highly infectious nature of the air of close and crowded jails has long been known. “The most pernicious infection, next the plague, (says Lord BACON,) is the smell of the jail, when the prisoners have been long, and close, and nastily kept; whereof we have had in our time experience twice or thrice,

when both the judges that sat upon the jail, and numbers of those who attended the business, or were present, sickened upon it and died. Therefore it were good wisdom that in such cases the jail were aired before they be brought forth.”*

But it were superfluous longer to dwell upon the nature, effects, and importance of perspiration. It is intimately connected with health. Its influence in modifying the character of disease has long been known, and particularly demonstrated by those who have most successfully directed their attention to the nature and cure of febrile, and of malignant and pestilential diseases. Of all the various methods had recourse to in the treatment of the yellow fever, which has at different times prevailed in the United States, what may be denominated the

* BACON, Works, vol. ii. p. 49. Lond. ed. 1803. *Vide* also BLANE, Diseases of Seamen; LIND, Papers on Infection and Contagion; CHISHOLM, Essay on the Malignant Pestilential Fever; *Ibid.* Letter to HAYGARTH; Sir JOHN PRINGLE, Diseases of the Army; FERRIAR, Medical Histories and Reflections; HAYGARTH, on the Small Pox, &c.

sudorific plan appears to have been by far the most successful. Its decidedly beneficial effects were amply evinced in the long and extensive practice of the venerable Dr. JOHN BARD, and of Dr. SAMUEL BARD, during the repeated visitations of that epidemic in the city of New-York, since 1743.* Its advantages over the mercurial plan of treatment were fully tested in the practice of Dr. HOSACK.†

A similar remark may be made concerning the importance of the sudorific method of cure in the typhoid peripneumonia, which, within these few years past, has so extensively prevailed in the eastern and middle states. “The practice which has been by far the most generally

* MS. Notes on HOSACK'S Lectures on Theory and Practice of Physic and Clinical Medicine.

† See also Dr. JOHN MITCHILL'S Account of the Yellow Fever of Virginia; HOSACK and FRANCIS' American Medical and Philosophical Register; Facts and Observations, and Additional Facts and Observations of the College of Physicians of Philadelphia; HOSACK, on the Yellow Fever of New-York, in CURRIE'S Sketch of the Yellow Fever of Philadelphia; CURRIE, on Synochus Icteroides; and other writers in MITCHILL and MILLER'S Medical Repository, &c.

pursued, and considered of primary importance," observes the committee of the Massachusetts Medical Society, in their elaborate and interesting Report, "is to produce early and long continued sweating."* "By this evacuation we not only counteract the general vitiated state of the fluids, but we at the same time diminish, and in some cases, totally remove the local irritation which affects the lungs and other organs involved in this disease."† The observations of Dr. WILLIAMSON, made during the prevalence of the same disorder in North Carolina, lead to the same conclusions.‡

Thus far of the nature, causes, and effects of acrimony in general. To enter into a conside-

* *Vide* Report of the Mass. Med. Society, in their Medical Papers, vol. ii. part ii.

† HOSACK, on the Peripneumonia Typhodes, in the Amer. Med. and Philos. Register, vol. iii. p. 452.

‡ Observations on the Malignant Pleurisy, in Amer. Med. and Philos. Register, vol. iii. p. 453; see also New-York Medical Repository; New-England Journal of Medicine and Surgery; Low, on the Epidemic Pneumonia, and other papers in the Amer. Med. and Philos. Register.

ration of the different kinds of acrimony that have been noticed in the schools, or to attempt to investigate their peculiar nature or specific quality, is deemed unnecessary. Nor, indeed, does it much signify as to the effect produced, what the acrimony is; acrimonious substances differing principally in a greater or less degree, and a more or less durable action.* They all appear to act as stimuli in irritating the solids and in exciting the action of the heart and arteries; while at the same time they tend to destroy the healthy crasis of the blood and humours.

But according to the different nature of each, peculiar medicines must be employed to correct and oppose the particular kind of acrimony. In general it will also be necessary to have recourse to a judicious employment of diaphoretic remedies; and to dilute and carry off the acrid materials, by the plentiful use of diluent, watery, and mucilaginous drinks and medicines;†

* VAN SWIETEN, Commentar.

† HOFFMAN, Medicin. Rational. System. tom. iv. part. v. cap. 1.

with which it will, for the most part, be proper to mix acids, both vegetable and mineral, especially where there is much excitement, where heat is to be moderated, a tendency to putrefaction prevented, or where the acrimony is of the alkaliescent or putrescent kind. For it appears, that acids are both highly refrigerant and antiseptic; and whether in these circumstances they produce their beneficial effects by diminishing sensibility and irritability; or by correcting and changing the alkaliescent salts; or by condensing the humours and fibres; or in all these ways, is of little consequence.*

It would also be foreign to our purpose to particularize the various degrees and sorts of acrimony or other morbid qualities which may be produced in the blood and humours by the introduction of various miasmata, or specific contagions. It may be observed, however, that each species of contagious particles produces a distemper of its own kind. Thus, the *variola* produce the small pox, the *morbilla*

* BURSERIUS, Institutions of the Practice of Medicine, vol. i.

the measles, the *pestilential* the plague, and so of other diseases propagated by specific contagions. But the extreme subtlety of contagious miasmata is such as to elude the examination of the senses ; of consequence we are unable to ascertain their peculiar nature or qualities, and must rest contented with being able to trace their operation and effects upon the living human body. One circumstance, however, connected with the operation of contagions, and which particularly characterizes their action, is that wonderful faculty which they possess of transmuting many parts of the sound humours of the human body into a similitude with themselves ; and thereby diffusing through the blood a morbid quality of the same species and denomination with the disease from which they originally proceeded. But of this more will be said hereafter.

How these subtle and invisible miasmata, when received into the body, are able so to injure the texture of the solids and fluids, and excite such wonderful commotions in the system, it is impossible to say. But that such effects may proceed from acrid poisons, plainly

appears from what happens to those bit by the hæmorrhoids, a Lybian serpent, the effects of which are so beautifully described by Lucan :

Impressit dentes Hæmorrhoids aspera Tullo,
 Magnanimo juveni, miratorique Catonis.
 Utque solet pariter totis se effundere signis
 Corycii pressura croci, sic omnia membra
 Emisère simul rutilatum sanguine virus.
 Sanguis erant lacrimæ : quæcumque foramina novit
 Humor, ab his largus manat cruor : ora redundant,
 Et patulæ nares : sudor rubet : omnia plenis
 Membra fluunt venis : totum est pro vulnere corpus.*

* Pharsaliæ, lib. ix. v. 366.

Dissolved and Putrescent State of the Blood.

Beside the several morbid conditions of blood which have already been noticed, there is another of a still more dangerous and complicated nature, and in which this humour more immediately tends to *dissolution* and *putrefaction*.

Such evidently appears to be the case in some scorbutics, and likewise in putrid, malignant, and pestilential fevers.

What degree of resolution in the blood is necessary to denominate this fluid putrescent, or putrid, or to what extent a putrescency of it may actually take place while circulating in the vessels of the living human body, is difficult to determine; but such a degree of corruption, or putrefaction, as is by some authors spoken of, is certainly incompatible with life.

As soon as the principle of animality or life abandons the body, it becomes immediately and totally influenced by physical laws, to which all inanimate and inorganized bodies are subject. It now performs a retrograde process, and becomes decomposed. This decomposition, which is called putrefaction, totally destroys the natural texture or consistence of the animal substance, and produces an entire resolution of its component principles.

The capacity of change in bodies is in a direct ratio with the multiplicity of their elements; so that the preservation or existence of

an organized being after death is protracted so much the longer in proportion as its constituent principles are less numerous and volatile.* It is for this reason that the fluid and softer parts of our body putrefy more readily than the solids or firmer parts. Putrefaction, indeed, never takes place in those animal substances which contain only two or three ingredients, such as oils, resins, &c. but they must always be more complicated in their texture or composition.†

But however complicated the animal substance, it does not putrefy without the presence of a certain degree of heat and moisture, which are the two great and essential requisites to putrefaction. Both of these requisites exist in the living system, and the former, too, according to the valuable experiments of Dr. ALEXANDER, about that degree which is best calculated to promote the putrefaction of dead animal matter. This process also advances with greater

* RICHERAND, *Elements of Physiology*, p. 462.

† THOMSON, *System of Chemistry*, vol. v. p. 770.

rapidity in the open air; “but exposure to air is not necessary, though it modifies the decomposition.”* In this respect also, the human body is in that situation in which putrefaction would most readily take place; for there is not only a constant application of the ambient air to the surface of the body, but it also enters deeply within by respiration; and we are perpetually swallowing the same with our food and drinks; so that it is not improbable that a portion of air may be intermixed or combined with our fluids, and even incorporated with the solids themselves. It is fully ascertained, that a small quantity of air may be gradually and slowly conveyed into the veins of an animal without producing death.† The celebrated HUXHAM, indeed, thinks it probable, that elastic air is sometimes even generated in the blood vessels, in putrid fevers. The learned Dr. PRINGLE was induced to believe, that several symptoms in the true scurvy might be owing to the action of air, within the vessels,

* THOMSON, *ut supra*.

† *Vide* PRINGLE, Diseases of the Army, Append. p. lxxxix.

either wholly detached from the blood and other humours, or but loosely connected, or imperfectly incorporated with them.

Since, then, the living body is constantly under all the necessary and most powerful circumstances of putrefaction, and nevertheless the whole body of a living person has never been found absolutely putrid; it necessarily follows, that there is in life itself, independent of every other circumstance, a preservative power, which by its influence effectually resists putrefaction, and keeps the animated machine from total decomposition.

It has been alleged, that the great and principal means by which the human body is preserved untainted by putridity, is the constant elimination of putrescent matters from the system by the various excretions, and the daily succession of fresh materials from without, which repair the expenditures and degeneracies occasioned by the actions of life.* This doubt-

* *Caro animata cur vivit et non putrescit ut mortua ? quia quotidie renovatur. SANCTORIUS, Aphor. 30.*

less has very considerable influence in this respect; but it is nevertheless of subordinate importance compared with the astonishing antiseptic powers of the vital principle. For it is well known, that a person may live under every situation most proper for putrefaction, without any sensible evacuation from the body, or without any thing being taken in for twenty-four hours; and yet no general and absolute putridity shall take place. If, however, the same person had from some accident been suddenly deprived of life, and the dead body been retained for the same time in a temperature of 98 of Fahrenheit, a violent degree of putrefaction would have taken place.

In order to establish general putrefaction in the body, it must be absolutely deprived of life. The living principle, whatever it may be, forms the most powerful antiseptic. It is this principle which, being universally diffused throughout the whole body, incessantly acts upon both the solids and fluids, and so long as it remains unimpaired effectually preserves the animal substance from dissolution. It modifies, without

ceasing, the impressions of external agents ; and impedes the degenerations depending upon the actions of life, or upon the constitution itself.

In proportion, therefore, as the vital power is either weakened or destroyed, the tendency to putridity in the body will become more strong. Hence it is, that the strongest putrid symptoms generally appear so soon in all fevers, which are attended with early and universal debility, or with great and sudden depression of strength. The celebrated BECCHER, in speaking of the causes which produce putrefaction in living bodies, elegantly observes :—"Causa putrefactionis primaria defectus spiritus balsamini est.*

The blood in the aggregate possesses preservative properties, which it derives from the living principle it contains in common with the solids. The doctrine of vitality in this fluid, as we may learn from sacred history, has been entertained from the remotest antiquity.† The

* BECCHER, *Physica Subterranea*, lib. i.

† *Vide* Leviticus, chap. xvii.

same opinion was entertained by ARISTOTLE,* and by many other ancient philosophers. This idea is also clearly expressed by VIRGIL:

Ille rapit calidum fustrà de vulnere telum :

Unâ eâdemque viâ sanguisque animusque sequuntur.†

The great HARVEY, in his celebrated work on animal generation, expresses, in the most decided manner, his belief, not only that the blood is itself possessed of vitality, but that it is the immediate source of being and life to the rest of the system. Among other innumerable observations to the same effect, he has the following. *Clarè constat, sanguinem esse partem genitalem, fontem vitæ, primùm vivens et ultimò moriens, sedemque animæ primariam; in quo (tanquam in fonte) calor primò, et præcipuè abundat, vigetque; et à quo reliquæ omnes totius corporis partes calore influente foveantur, et vitam obtinent.‡* The first, however, who brought

* De Hist. Anim. lib. iii. cap. 19.

† VIRGIL, *Ænid.* lib. x. v. 486.

‡ HARVEY, De Generat. Anim. Exerc. li.

this subject to the test of experiment, was Mr. JOHN HUNTER. His interesting and well directed inquiries and observations; and still more recently those of the able and ingenious Dr. CALDWELL* of Philadelphia, have most satisfactorily established this physiological fact.

Since, then, the blood evidently appears to possess vital powers in common with the solids themselves, and since life and putrefaction are two ideas absolutely contradictory and incompatible with each other; it necessarily follows, that an absolute and universal putrefaction of this fluid can never take place during life. Of a quality of this active nature, inevitable death would be the immediate consequence. The term putrid, then, which conveys the idea of actual decomposition and death, is improperly applied to express any morbid condition of the vital fluid, which occurs during its circulation through the vessels.

When, therefore, in particular diseases, the animal fluids undergo certain changes, tending

* Experimental Inquiry on the Vitality of the Blood.

more or less to a state of putrefaction, this *tendency* to putridity ought not to be confounded with putridity itself. Such an *incipient* state of putrefaction in the humours will be more accurately expressed by the term *putrescent*, or *putrescency*, not as signifying a state of actual putridity, but a near approximation to such condition; that is, when the humours have so far degenerated that they would undergo decomposition and putrefaction with far greater ease, and more facility, than when in a sound and healthy condition.

It is the opinion of some of our most distinguished physiologists, that even the most healthful bodies have naturally and constantly some tendency to a state of putrefaction, which appears especially in the evolution and generation of those saline and putrescent matters which are carried off by the natural excretions. If such be the case in health, it must obviously be much more so in certain diseases; and that, perhaps, to such a degree as eventually at times to overcome the vital principle itself. Now, the seat of this affection appears to be more espe-

cially in the blood and other fluids. It is with the view of averting the evil that would necessarily ensue to the system at large, were the death and putrefaction of the blood permitted, that there are particular organs which are especially destined to supply it with a daily influx of fresh materials, and preserve the whole in a renovated and living condition. It is obvious that all aliment, previously to its being able to nourish or transfer any restorative influence to the muscular or more solid parts, must, in the first place, make its way into the vital fluid. When deprived for any considerable time of this necessary refreshment from cooling and nutritious aliment the blood and all the humours, as was before observed, become more acrid and putrescent. An animal that is starved to death does not appear to perish from inanition, or from an insufficient quantity of blood and other humours; but rather from a corrupt and putrescent state of them: in proof of which the use of water alone will keep it much longer from starving. But as water is entirely destitute of those mucilaginous principles, which are at present esteemed the

nutritive part of our food, it can scarcely be supposed that it produces this effect by affording any nourishment. It must therefore do it by diluting the fluids, or carrying off the noxious matters, and in this manner preserving them from this putrescent state. Dr. LIND* remarks, that he has always observed that the most rigorous of the Romish clergy, who are in the habit of frequent fasting, are greatly scorbutic, and remarkable for a fetid and most offensive breath. "Can we ascribe this sudden effect of fasting to a disease originating in the solids? Is it not more consonant to the laws of the economy, that the blood being deprived of regular supplies of mild and nutritious chyle, must be first affected by this loss, and that the solids suffer in a secondary way only."† But whether the putrefactive tendency be more strong in the solids or in the fluids, we may justly suppose that a quality of the active nature of putrefaction would quickly communicate its pernicious taint to every part of the corporeal frame.

* On Scurvy, p. 323.

† WALKER, on Small Pox, p. 108.

With respect to the peculiar or actual condition of the blood in those diseases usually denominated putrid or malignant; though it can hardly be supposed, that a true and perfect putrefaction of this fluid, corrupting the whole mass, totally destroying its mixture, and resolving its component parts, can for the shortest time exist in the living body, it being repugnant to, and entirely incompatible with life; yet an approximation or rapid tendency to this state, or rather, what Professor HOSACK, in his lectures on the theory and practice of physic, very aptly and judiciously denominates an *incipient* putrefaction, is compatible with life, though not with health, and evidently takes place in such diseases.

This putrescency, or incipient putrefaction of the fluids in certain disorders, is evident, in the first place, from the appearances of the blood itself, when drawn from the vessels. The ingenious Dr. MILMAN, in his inquiry into the source whence the symptoms of the scurvy and of putrid fevers arise, very properly describes the effects of putridity on the blood. "If putridity," says he, "actually took place

in the vital fluid, its effects would be, to break down the texture of its parts, as it does that of every body; it must render it incapable of coagulation.”* Now, this is a condition of the vital fluid very similar to what physicians have noticed in certain diseases, particularly in putrid, malignant, and pestilential fevers;† in some scorbutics;‡ and in the putrid,§ or petechial fever|| of small pox; in all of which the crasis of this fluid is much injured and dissolved. The consistence is very different from the ordinary appearance of healthy blood, its texture

* MILMAN, Inquiry, p. 55.

† In morbis putridis dissolutio cruoris quoque advertitur, præsertim pestis specie, in quibus non coagulatur sanguis, sed gangrænosus et putridus reperitur; quod etiam in eo sanguine observatur, qui post protractam inediam putridus et alcalinus factus est. SCHWENKE, *Hæmatolog.* p. 129.

‡ Vide HUXHAM, Essay on Fevers; Ibid. De Aere et Morb. Epidem.

§ WALKER, on Small Pox, p. 109. &c.

|| — Nam in tanta pestilentia (scil. variolæ,) sanguinis crasis dissolvitur penitùs, et maximè putrescunt humores: imo cruor emissus, putris instar saniei, diffluit; nec ut solito, in frigore coagulatur. HUXHAM, *De Aere et Morb. Epidem.* vol. i. p. 105.

being so much weakened, or broken down, that either the coagulum is very loose, or it does not coagulate at all, or show any disposition to separate into crassamentum and serum as usual, but the whole remains quite fluid and dissolved. HUXHAM* assures us, that blood of this character always putrefies very soon.

That acute and accurate observer, the late Dr. FORDYCE, has noted the appearances of the blood through almost all the different stages of a putrid fever. In the beginning, says he, when the putrefaction has not gone to any great length, if blood should happen to have been taken from the arm, the coagulum is loose and easily broken, the serum being hardly of a browner colour than common; but it becomes much more so when the putrefaction is further advanced. In a still further degree it is red:† in this case, continues he, on examining the red particles with a microscope, many of

* Essay on Fevers, p. 42.

† See also HUXHAM, *De Aere et Morb. Epidem.*; and likewise his *Essay on Fevers*.

them are found diminished in size, and not regular spheres, or oblate spheroids; some have the appearance of being broken in two, and look like half moons. If the putrefaction goes on still further, there is hardly any distinction between serum and coagulum.*

“Blood being drawn in the beginning of putrid diseases,” says Dr. SHEBBEARE, “the crassamentum, though very rubicund, scarce adheres together; in the process of the disorder it becomes still of a looser texture, and more putrid hue, till in some very desperate cases, it is not better than a sanies or putrid ichor.”†

Beside these several morbid appearances, some justly celebrated physicians, and more particularly VANDER MYE,‡ FERNELIUS,§ MOR-

* FORDYCE, Third Dissertation on Fever, part i. p. 92.

† SHEBBEARE, Practice of Physic, vol. ii. p. 169.

‡ De Morbis Bredanis, p. 14, as quoted by VAN SWIETEN.

§ Sanguis qui per febres putridas detrahitur, sæpe animadvertitur non solum fœtidus et graveolens, sed et putridus adeo ut nec sibi cohærere nec concreescere queat, omnibus scilicet ejus fibris putredine consumptis. FERNELIUS, *De Febris*, cap. v. p. 246.

TON,* SIR JOHN PRINGLE,† and others, have even mentioned the absolute fetor, or offensive smell of the blood recently drawn.

The putrescent state of the fluids is further evinced by

A loathing of animal food, nausea, vomiting, thirst, and a desire of acids.

By hemorrhages from various parts, without symptoms of increased impetus.

By certain spots or marks called petechiæ, maculæ, and vibices, which are generally supposed to be owing to the effusions of dissolved blood below the skin or cuticle.‡

* Denique notatu dignissimum est, quod mihi nuperrimè videre contigit, sanguis feminæ ejusdam, febre maligna laborantis, per phlebotomiam detractus adeo fœtebat, ut ex ejus tetro odore tam chirurgus quam adstantes in animi plane deliquium inciderint. MORTON, *Pyretolog.* p. 26.

† On Jail or Hospital Fever, p. 337.

‡ Hæ maculæ oriri videntur ab infractis, aut dissolutis, sanguinis globulis, arteriolas serosas intrantibus; dumque ibi hærent, petechias formant, aut vibices. Pestiferæ semper sunt, quod cruorem putridum esse, aut maximè solutum, denotant: imò adeo sæpe dissolvitur sanguis, ut profusæ subsequantur hæmorrhagiæ. Quod quidem scorbuticis quoque accidit crebro, cùm

By the fœtor of the breath, urine, and perspiration, together with the cadaverous smell of the whole body.

By the peculiar kind of acrid or biting heat that is commonly experienced on touching the skin of persons labouring under putrid malignant fevers. The heat at first seems inconsiderable, but on continuing the hand a longer time upon the skin, a disagreeable, pungent, or stinging sensation is felt in the fingers, which even remains some few minutes after they are removed from the sick. This fact has been particularly noticed by Sir JOHN PRINGLE,* and, as he candidly observes, by GALEN long before him. The same, however, had also been distinctly remarked by FERNELIUS.†

ne vel minima febris signa adsint, etsi totus fere corporis habitus innumeris violaceis maculis inficitur; qui tamen mox, ac ne quidem tale quid somniantes, funesto sæpe sanguinis fluxu corripiuntur: iste tamen cruor nunquam, more solito, concrecit. HUXHAM, *De Aere et Morb. Epidem.* vol. i. p. 116.

* PRINGLE, on Jail or Hospital Fever, p. 292.

† Calor in febre putrida non mitis ac blandus, sed acer, mordax et qui tangentis sensum acriter feriat, non ipso invasionis initio,

Lastly, by the surprisingly great and speedy corruption that generally takes place in bodies dying of putrid, malignant, and pestilential diseases.*

To what has been already said upon the nature and effects of putrescency, it may not be improper to subjoin the following observations of Dr. GREGORY: Quandoque autem massa sanguinis putrescit multum, non modo acris fit, sed solvitur quoque, ægre cogitur, et tenue et rarum crassamentum ostendit: quin et ipsæ particulæ rubræ dilabuntur et franguntur. Sanguis vero sic solutus et acer, tum propter salem evolutum, tum propter gluten suum rancidum et putridum, vasa sua stimulat, eroditque, et ex iis elabitur; et maculas primo rubras, postea livescentes vel nigrescentes, tumores, ulcera vix sanabilia nisi tempestive putredini occurratur,

sed vel in augmento, vel in statu, idque maximè si diutius corpori manus insideat. FERNELIUS, *De Febris*, cap. vii. p. 249.

* HUXHAM, *De Aere et Morb. Epidem.*; Ibid. *Essay on Fevers*; HOSACK, MS. *Notes on the Theory and Practice of Physic and Clinical Medicine.*

sanguinis profluvia ab omni corporis parte vix compescenda, et foetorem insignem et intolerabilem halitus et omnium excretionum facit; et laxitatem solidarum partium, summamque debilitatem, (quia *generi nervoso* veneno est,) et mortem tandem, talis corruptio inducit.*

The subsequent quotation from the learned Baron HALLER, supersedes the necessity of any further remarks on this part of the subject; Quæ motus musculorum, eadem febris facit, quæcunque ejus origo fuerit: dum sanguinis motum vehementius augeat. Putrescunt in febre humores, et in variolis, et in petechiali genere, flavaque illa insularum antillarum peste, sanguis foetidus per os et nares erumpit. In variolis confluentibus penetrabilem foetorem sæpe expertus, nullis aceti in planas patinas expositi contrariis vaporibus satis emendare potui. Ipsum inde lac ebutyratum, et citri succus putrescit. Foetent ante mortem, qui febre paludosa putrida laborant. Foetorem combustarum solarum similem, adeoque alcalinum, in malignis,

* GREGORY, *Conspectus Medicinæ*, § 584.

sudoremque enormiter olentem SEGERUS observavit. Funestus cadaveris odor in hominibus peste laborantibus percipitur, qualem ab ægro ipso perceptum memini in bibliopola propriæ mortis certa præsentia dedisse: is autem in peste ordo inficit, lateque malum propagat. Mira virulentia humorum in hominibus est, qui peste pereunt, et sanguis ipse foetet, et vapor destillati de pestilente bubone puris quasi fulminis ictu male curiosum medicum prostravit. Corpora hominum peste extinctorum, aut paludosa febre, continuo putrescunt.*

The *causes* of putrescency in the animal fluids, which come next in order for consideration, being in almost every respect the same with those of acrimony, which have been already sufficiently dwelt upon, it would be unnecessary again to enumerate them in this place. A few observations, however, upon some of the principal ones may not be improper.

Neither the whole, nor any part of the living human body, notwithstanding it has some of the

* HALLER, Elem. Physiol. tom. ii. p. 25.

most powerful causes of putrefaction interwoven with its very existence, ever runs into this state during life, except previously inclined thereto by the operation of some powerful cause or causes, though these may not always be discoverable. On the contrary, when life is extinct, almost the whole animal substance invariably and spontaneously putrefies, unless prevented by the influence of forcible agents. But as it respects matter and construction, the animate and inanimate body are exactly the same. That the former, therefore, is less inclined to putridity than the latter, must be owing to something which it enjoys during life, but is deprived of when dead. Now as to life itself, we are totally ignorant of its nature or essence. We know not in what it consists, nor even the powers of which it is possessed. Respecting its action or mode of producing its various effects, no satisfactory explanation has yet been given. Instead, therefore, of indulging in ideal conjectures concerning things which we do not understand, let us rather endeavour to seek some other cause why the animal body is so seldom attacked by putrefac-

tion during life; and perhaps this cause, if it can be discovered, may throw some light upon the reasons why the body sometimes does suffer by it.

It was on a former occasion remarked, that one of the principal means employed by nature in obviating or retarding the tendency of animals towards a putrid state, is the regular and constant supply which the blood daily receives of fresh and antiseptic materials, taken in by way of food. But a second, and perhaps still more powerful cause, is motion.* There may be, and unquestionably are, many other subordinate causes which co-operate with these two, but as their power is probably much more limited, we shall pass them over without any particular notice, and at present only consider the effects of irregularities of the animal motions, which, we believe, will of themselves be found fully adequate to the production of putrescency,

* *Quamdiu æquabili motu per vasa circumducuntur humores, nulla nascitur in corpore putredo, omne illud, quod inciperet disponi ad putredinem, solitis corporis viis eliminatur.* VAN SWIETEN, *Commentar.*

without the existence of putrid miasmata, or any other external power.

That motion is one of the great and principal agents by which bodies or substances of various kinds are preserved from a state of putrescency, is a truth confirmed by daily observation ; and the reason of its being so strong and universal an antiseptic will perhaps more fully appear by a little attention to the phenomena that accompany bodies while putrefying.

A great variety of repeated experiments and observations have demonstrated it to be an invariable law of nature, that an intestine, or as it is more usually styled, a fermentative motion must necessarily precede a state of putrefaction in dead animal and vegetable substances. But in order that this fermentative motion may more readily take place, it is necessary that the parts of the body upon which it is to operate, be in a state of repose among themselves ; for if they be put in motion by any external cause, or impelled by any *vis a tergo*, in the manner of the circulating fluids of the animal body, they will be much less susceptible of motion from any

other cause, which, previously to its being able to operate upon them, must first overcome the motions impressed upon them *ab extra*, or destroy the force by which they are already urged.

Hence the greater purity of running water, and that of the sea when agitated by the winds, in comparison of the same when stagnating. The ocean is in a state of perpetual flux and reflux; and by this motion is it preserved fresh. It is only in marshes and some stagnating lakes that water is ever found putrid, according to the common expression; for water of itself appears to be a non-putrescible substance, and it is only by being impregnated or mixed with other corruptible matter that it actually becomes putrid.

Since then it appears that a state of rest is favourable to putrefaction, and a state of motion unfavourable to it; and since it is certain that independent of the loco-motive faculty of a living body, all its various parts are in perpetual motion among themselves, we may very justly conclude, that motion is one of the causes of the preservation of the animal body from putrefaction during life, and the loss of this vital motion

one of the causes of its destruction or corruption after death. The blood is constantly performing the rounds of the circulation, which, when properly regulated, evidently possesses a power of preventing its putrefaction;* yet this motion appears to be endowed with such a power only, in consequence of its enabling the vital fluid to throw off such matter as would corrupt it, if retained too long in the vessels; and also by counteracting the fermentative motion, which is found to be absolutely necessary towards producing putrefaction in dead animal matter.†

* On this subject, showing that the circulatory motion of the blood impedes its putrefaction, the reader may consult HALLER's *Elementa Physiologiæ*, tom. ii. lib. vi. sect. iii. § ix. et xiv.; and also Dr. ALEXANDER's *Experimental Inquiry*, to which able and interesting work, the author is particularly indebted for many observations.

† Si accuratius rationem exquisiveris, qua motus putredinem avertat, duplicem inveniemus. Nam progressivus motus intestino resistit, neque adeo sinit fermentationem obtinere, neque fere putredinem. Deinde vitalis motus sanguinis, organorumque sani hominis, humores putrescibiles continuo expedit et abigit, et quæ ad urinosam acrimoniam accedunt, ea per cutaneam perspirationem, per urinam, cumque alvi fæcibus expurgat et ejicit. HALLER, *Elem. Physiol.* tom. ii. p. 303.

The blood and other juices will easily putrefy, either in the whole or any part of the body, by being entirely deprived of their accustomed motions.* If, for example, by a tight ligature or other means, the vital or circulatory motion of the blood be stopped in a leg or an arm, a mortification soon follows. The same thing frequently happens when from an internal obstruction, the influent juices are denied admission into any member or part of the body; but in both these cases the most obvious cause is the loss of motion. In short, the tendency of the animal fluids to corruption or putrefaction will, *ceteris paribus*, be greater or less according to the degrees of motion impressed upon them by the heart and their contractile vessels.

We have hitherto insisted upon the power of motion and antiseptic food, in retarding or counteracting the putrescency of the animal fluids; but the motion all along alluded to is that called vital or involuntary, which must not be con-

* Nam in toto humano corpore, et in singulo artu, continuo humores putrescunt, quando motus suppressus est. HALLER.

founded with the intestine or fermentative ; the former tending to the preservation, and the latter to the destruction of the animal body. But although the vital motions, when properly regulated, assist in preserving the humours from putrefaction, yet when they run to either extreme, they actually produce a contrary effect ; that is, putrescency will be brought on by the circulation being rendered too slow,* or too rapid,† and thus the same effect will be produced by two directly opposite causes.‡

The circulation being too much retarded, the blood will be less able to throw off such excre-

* *Sublato motu progressivo sanguinis subita putredo nascitur.* HALLER, *Elem. Physiol.* tom. ii. p. 303.

† *Longe autem citius in putredinem abeunt humores animalium, si valide moveantur, si valido cursu, vel alio labore, quis corpus exercuerit. Quam olidus sudor, quam acris et fœtida redditur urina, dum febris acuta lactantemprehendit mulierem? Nisi plurimum potet, intra paucas horas lac fiet tenue, subflavescens, salsum, odoris suburinosi.* VAN SWIETEN, *Commentar.* § 80.

‡ *Motus nullus, et motus nimius liquidorum nostrorum, producant putredinem; sicque binæ causæ penitus oppositæ producant eundem effectum.* *Ibid.* § 34.

mentitious matters as would corrupt it, if retained too long in the vessels; whilst at the same time the constituent parts of this fluid will be more apt to fall into intestine or fermentative motions, or to obey their respective attractive powers, by means of which they are brought into a state of corruption or putrescency. Hence it is that putrid symptoms so generally appear in the advanced stages of all continued fevers; for these, by quickly exhausting the strength of the vital or moving powers, dispose to sudden and universal depression of strength, which, according to Dr. FORDYCE,* constitutes the principal cause that determines the putrefactive tendency of the humours in fevers. But as debilitation, or depression of strength, produces putrescency of the fluids, so, on the contrary, putrescency of the fluids, in whatever manner produced, occasions depression of strength, and sometimes in a degree that proves fatal.

How an excess of motion should also produce putrescency of the animal fluids is perhaps not

* See his Third Dissertation on Fevers, part i.

easy to determine. It is probable, however, that it produces such an effect both by exhausting the vital energies of the system, and by breaking down the texture of the vital fluid itself, or destroying the bond of union among its insensible particles, and depriving them of that plastic or cohesive principle, by the possession of which the whole circulating mass is kept in its sound and natural state, and by the loss of which it degenerates into a morbid one. For, according to BECCHER,* rarefaction or relaxation is the first effect of putrefaction. As an increase of temperature generally attends febrile action, it has been supposed that the putrescency of the humours might be owing in a great measure to this increased heat.† But Dr. SHEBBEARE‡ affirms that the degree of animal temperature in putrid diseases, and particularly towards their last stages, is even less than that which naturally belongs to perfect health ; which

* BECCHER, *Physica Subterranea*.

† *Vide* CLARK, on Fevers, &c.

‡ SHEBBEARE, *Practice of Physic*.

would appear completely to overthrow the Boerhaavian* doctrine of heat being the cause of putrefaction. But be this as it may, it is certain that violent febrile motion has frequently produced a putrid diathesis of the blood and humours, in the short space of one or two days.† The same thing happens from vehement exercise or muscular motion.‡ The flesh of animals run to death quickly putrefies.§

From what has been said above on the effects of motion and rest applied to the animal body, the conclusion appears obvious that putrid symptoms may arise either from a defect or an excess

* *Vide* BOERHAAVE, *Elem. Chem.* tom. i. cap. De Igne, *Exper.* xx. *Coroll.* 16.

† *Nimia agitatio longe adhuc celerius putredinem inducit. Acutissima febris intra 24 horas sic potest corrumpere omnia, ut urina fœtida, fœces alvinæ cadaverosæ penitus, halitus oris putridissimus, interna omnia jam corrupta testentur. VAN SWIETEN, Commentar. § 34.*

‡ *Corporis vehementior exercitatio sola, urinam fœtidam, acrem, urentem reddit, sudorem ingratum nidorem olentum, sanguinem acrem, febresque omnium ardentissimas, et subitas mortes. HALLER, Elem. Physiol. tom. ii. p. 34.*

§ *Ibid. p. 35.*

of the vital motions. Of consequence, whatever causes such defect or excess will have a tendency to bring on a putrid disposition of the fluids. Putrid diseases, therefore, may be generated in the individual without the agency of miasmata, or any other cause *ab extra* ;* for the animal body, having in itself a constant tendency to, and possessing in an eminent degree the necessary requisites for putrefaction, will spontaneously run into that state, whenever the causes that perpetually obviate or counteract this disposition shall be suspended or taken away.

Such putrid diseases as involve the whole system, may arise either from a too rapid, or too languid circulation; from the use of unwholesome aliments, or an insufficient quantity of nourishment; from the suppression of perspiration; or from the introduction of contagion or putrid miasmata.

* Though it is stated above that putrid diseases may be generated in the individual without the aid or co-operation of contagion, it is not thereby intended to preclude its agency in this respect, as these disorders may be, and undoubtedly are, also caused by it.

As to the peculiar manner in which *miasmata* produce putrid symptoms, whether it be by first contaminating the juices, and assimilating them to their own corrupt nature; or whether they possess sedative properties by which they weaken or paralyze the moving powers, and thus have a tendency to produce putrefaction; or whether, on the contrary, being received into the blood, they act as stimuli in exciting the heart and arteries to more frequent and forcible contractions, thereby hurrying on the circulation in such a way as to promote a dissolution and putrescency of the fluids, it is not easy to determine, nor is it our business particularly to inquire.

The putrid miasmata, which infect our atmosphere, may not improperly be divided into vegetable, animal, and vegeto-animal. *Marsh miasmata*, or the effluvia arising from marshes, lakes, and stagnating waters of all kinds, where a variety of dead vegetable and animal substances are putrefying together, are universally allowed to be the cause of intermittents in all countries. In those countries, too, where such

intermittents are common, continued fevers not unfrequently appear in the autumn, which may be easily accounted for by the atmosphere being at that time more generally loaded with noxious and putrescent vapours, which arise from the decomposition of large quantities of decayed animal as well as vegetable matter.* That the diseases arising from this source frequently assume more or less of a putrid cast, appears to be established on the concurrent testimony of the most distinguished practitioners. The experiments of the sagacious Dr. ALEXANDER,† however, render it probable that such miasmata are the cause of putrid diseases much less frequently than has been generally imagined.

But the putrefaction of vegetables is generally supposed to be less noxious than that of animals.‡ Animal effluvia may be divided into two kinds. First, that which proceeds from dead animal bodies of any sort passing through the

* *Vide* M'GREGOR, Medical Sketches.

† ALEXANDER, Experimental Inquiry.

‡ PRINGLE, Diseases of the Army.

natural process of putrefaction in the open air, as sometimes happens from the accidental destruction of large quantities of frogs, fish, reptiles, insects, and a variety of other animals which multiply in such surprising numbers, particularly in warm climates; or from the prodigious slaughter occasioned by bloody battles between numerous armies. Secondly, that which arises from the exhalations from diseased or even sound bodies when closely crowded together in confined and ill ventilated apartments, as in jails, barracks, military hospitals, or the holds of transport ships. The malignant or highly infectious quality of this latter, which may not improperly be denominated animal contagion, as distinct from specific morbid contagion, is familiarly known.

Almost every writer, both ancient and modern, in enumerating the various causes of putrid epidemics, has reckoned the effluvia emanating from putrid animal matter as one of the most common. It is probable, indeed, that this kind of matter may have sometimes produced such an effect, yet if we were thoroughly to examine

the subject, it would perhaps be found to be the case much less frequently than has been generally imagined, and then, too, chiefly in the more sultry and less ventilated parts of the globe. In our northern climate, as well as in most European countries, the atmosphere is so changeable and so constantly agitated by frequent and sometimes violent winds, that no kind of putrid exhalations can long enough remain stationary in the open air, to be exalted into a degree of virulence capable of producing general infection, and much less of acquiring a pestilential influence,* before it is dispersed and swept away by violent or sudden gusts of wind. When, indeed, such exhalations are confined to a very limited space, and there concentrated and deprived of all chance of escaping, they may easily acquire a virulence capable of producing putrid and very fatal distempers, though they do not arise to the malignity of the true plague.

* No kind of putrefaction is ever heightened in these European countries to a degree capable of producing the true plague. MEAD, on the Plague. See also BLANE, Diseases of Seamen.

But although we, who inhabit the colder and better ventilated parts of the world, have little reason to dread a putrid contagion being generally diffused through the atmosphere, so as to contaminate any considerable region of it; yet are we assured that it has often infected individuals who have either come into actual contact with it, or unintentionally approached too near it, when in a confined and highly concentrated state. Neither are we to infer that all parts of the world are equally exempted from the influence of this effluvium. In many hot climates, where an uninterrupted calm almost perpetually reigns, the exhalations arising from animal putrefaction may accumulate in prodigious quantities, and remain undisturbed in the atmosphere till it is heightened by the heat of the sun into the most malignant qualities; and gradually contaminating surrounding objects, it is propagated from one to another, till it spreads to a considerable distance, tainting every thing in its way, and loading the atmosphere itself with the *semina* of disease and death. The propagation of such an infectious atmosphere is beautifully

described in a passage of LUCRETIUS, *De Rerum Natura*, which has, on a similar occasion, been quoted by Dr. HOSACK :

Proinde, ubi se cœlum, quod nobis forte venenum,
Commovet, atque aër inimicus serpere cœpit;
Ut nebula ac nubes, paullatim repit, et omne,
Quâ graditur, conturbat, et inmutare coactat.
Fit quoque, ut in nostrorum quom venit dinique cœlum,
Conrumpat, reddatque sui simile, atque alienum.

LUC. lib. vi. v. 1117.

But when the heaven, of poisonous power to us,
First moves remote, its hostile effluence creeps
Slow, like a mist or vapour ; all around
Transforming as it passes, till, at length,
Reach'd our own region, it the total scene
Taints, and assimilates, and loads with death.

Good.

But after all it may be much questioned whether mere putrefaction, or the effluvium of putrid and decomposed animal and vegetable matter, is not very distinct from the gaseous and subtle matter constituting a specific contagion ; more especially when we consider that the lat-

ter always produces the same peculiar and specific affection; whereas the diseases proceeding from the former source have been generally observed to assume great diversity of character. Dr. CHISHOLM, whose works will stand as lasting monuments of learning and medical science, is, after much inquiry and reflection, as he tells us, fully convinced, that the product of animal putrefaction never acquires a pestilential influence; *i. e.* that it is, under any circumstances, wholly inadequate to the production of pestilence, or the true plague, for which it has been so generally censured.* This distinguished philosopher is of opinion, that the effluvia from dead animal bodies, passing through the natural process of putrefaction, when applied in a concentrated state to the bodies of living animals, may act as poison, producing in the living animal frame, fever, perhaps, but incommunicable, or incapable of propagation by contagion.†

* CHISHOLM, on Contagion, in the Edinburgh Medical and Surgical Journal. 1810.

† Ibid. *loc. cit.*

But although the diseases produced by animal putrefaction never arise to the malignity of a true plague, the evidences are too numerous and too strongly supported to doubt that it has often produced putrid, or fatal distempers in particular bodies exposed to its action, and sometimes perhaps even putrid epidemics, particularly in hot, or tropical countries.*

It seems also to be an established position, that in proportion to the foulness of a place, or rather to the quantity of putrid vapours floating in its atmosphere, it will be more or less subject to pestilential fevers, or to receive and multiply the leaven of a true plague introduced into it either by merchandize or other means. Contagious and pestilential fevers appear to be always rendered more malignant in a foul than a pure atmosphere. The facility, too, with which they are communicated through the medium of a vitiated atmosphere, and the rapidity with which they are propagated would seem to warrant the idea, that the air surrounding the sick

* *Vide* FORESTUS, MEAD, PRINGLE, LIND, BLANE, &c.

becomes assimilated to the nature and character of the specific virus emanating from their bodies, by which means the poison is both multiplied and more widely diffused, so as greatly to increase the chance of communication to other persons. The malignity and increased mortality attending the plague of Athens,* and the pestilential fever of Rome,† u c. 239, would appear to have been owing principally to the great filth occasioned, not only by other circumstances, but more particularly by the great crowds of people, and by the large number of cattle of every description brought in for shelter from the country. This circumstance, attending the propagation of fevers communicable by a specific contagion, has been most ably and clearly illustrated by Dr. HOSACK, in his letters to Dr. CHISHOLM, on the subject of contagion. Speaking of the laws which govern the communication and propagation of plague, yellow fever, malignant dysentery, and the various forms of typhus,

* *Vide* THUCYDIDES, lib. ii. ; DIOD. SICULUS, lib. xii. cap. 14.

† LIVY, Hist. Rom. lib. iii. cap. 6.

Dr. Hosack remarks, that “ these diseases are only in general communicable through the medium of an *impure* atmosphere: in a pure air, in large and well ventilated apartments, when the dress of the patient is frequently changed, all excrementitious discharges immediately removed, and attention paid to cleanliness in general, these diseases are not communicated, or very rarely so, from one to another. But in an *impure* air, rendered so by the decomposition of animal and vegetable substances, as takes place in low marshy countries, or by concentrated human effluvia, as in camps, jails, hospitals, or on ship-board, they are rendered not only extremely malignant and mortal in themselves, but become communicable to others who approach the sick, or breathe the same atmosphere, which has become *assimilated* to the poison introduced, in so much, that *the same specific disease* is communicated, whether it be the *plague*, *yellow fever*, *typhus*, or *dysentery*.”*

* *Vide* Amer. Med. and Philos. Register, vol. ii.; and also the Edinburgh Medical and Surgical Journal. 1809.

Particular states of the atmosphere also favour the production of putrid diseases. This invisible fluid, it is well known, is constantly and indispensably necessary to animal life; and as we are perpetually in contact with, or surrounded by the same, and likewise swallowing it mixed with our aliments, as well as inhaling it every moment of life into the lungs, it is plain that the air itself, and of consequence any contagion or impurities inherent therein, may easily enter the body in considerable quantities, so as to penetrate every part of it. For this, as well as for other reasons, it has always been customary to consider a pure and wholesome air as one of the greatest sources of health, and its various changes, or impurities, one of the most frequent causes of disease.* Agreeable to which, whenever putrid diseases have become epidemic, and no visible

* Τοῖσι δὲ αὖ θνητοῖσιν οὗτος (scil. ὁ Ἀήρ) αἷτιος τοῦτε βίου, καὶ τῶν νοσίων τοῖσι νοσέουσι.—Μετὰ τοῦτο τοίνυν, εὐθίως ῥητέον, ὅτι οὐκ ἄλλοθεν ποθεν εἶκος ἐστὶ γίνεσθαι τὰς ἀρρώστιας μαλίστα, ἢ ἐντεῦθεν· ὅταν τοῦτο ἢ πλεον, ἢ ἔλασσον, ἢ καὶ ἀθροωτερον, καὶ μεμιασμένον νοσεροῖσι μολύσμασιν, ἐς τὸ σῶμα ἐσελθῇ. **HIPPOCRATES, De Flatibus.**

or manifest cause could be assigned, they were said to depend upon certain occult, or, as they were sometimes denominated, malignant qualities of the atmosphere. HIPPOCRATES* affirms that the air alone is the author and cause of all epidemic or pestilential diseases; and the reason why they happen to all indiscriminately, is that all breathe the same air in common.

But notwithstanding the frequent opportunities that physicians have had of witnessing the rise, progress, and declension of putrid, pestilential, and epidemic diseases in different parts of the world, we are to this day ignorant of their real cause. No medical subject, perhaps, is less thoroughly understood, or involved in greater obscurity. For so various are the natures or character of epidemics, even when the seasons and weather have appeared to be exactly the same, that the celebrated SYDENHAM, who had paid more than ordinary attention to this subject,

* Ὁ μὲν οὖν κοινὸς πυρετὸς, διὰ τοῦτο τοιοῦτός ἐστιν, ὅτι τὸ πνεῦμα ταῦτό πάντες ἔλκουσιν· ὁμοίᾳ δὲ ὁμοίως τοῦ πνεύματος τῷ σαματι μιχθέντος, ὁμοιοὶ καὶ οἱ πυρετοὶ γίνονται. HIPPOCRATES, *De Flatibus*.

did not hesitate to declare, that although he had carefully attended to the manifest qualities of the air, he had made no progress in discovering the causes of epidemical diseases; having remarked, that in different years, which perfectly agreed as to the manifest temperature of the air, the prevailing diseases were very different, and *vice versa*: so that he was led to conclude that they depended upon some secret or invisible quality in the air, which we have not yet, and perhaps never shall be able to obtain the smallest knowledge of.* But notwithstanding that we

* Quamvis autem diversas diversorum annorum habitudines, quoad manifestas aeris qualitates, maximâ quâ potui diligentia notaverim, ut vel exinde causas tantæ epidemicorum vicissitudinis expiscarer, ne tamen ne hilum quidem hactenus promoveri sentio; quippe qui animadverto annos quoad manifestam aeris temperiem sibi planè consentientes, dispari admodum morborum agmine infestari, et vice versâ. Ita enim se res habet. Variæ sunt nempe annorum constitutiones, quæ neque calori, neque frigori, non sicco humidove ortum suum debent; sed ab occultâ potiùs et inexplicabili quadam alteratione in ipsis terræ visceribus pendent, unde aer ejusmodi effluviis contaminatur. SYDENHAM, *De Morb. Epidem.* cap. ii.

are unable to discover all, or any of the hidden qualities of the atmosphere, there can be no doubt of its *manifest* qualities having a considerable share in the production of epidemic diseases, though they may not be able to produce them without the assistance of some other causes.

Heat and moisture are well known to be the necessary and most powerful causes of putrefaction. Agreeable to this, it has been found from experience, that a continuation of warmth and humidity in the atmosphere has generally been succeeded by some epidemic of the putrid kind; such as plagues, or pestilential fevers in southern, and intermittents, dysenteries, and malignant fevers, in northern regions. This is the pestilential disposition of the air described by HIPPOCRATES,* and by many succeeding physicians. We are informed by Dr. MEAD, that the plague usually invades Æthiopia whenever rains fall during the sultry heats of July and Au-

* De Morb. Vulg. lib. iii.

gust.* On the contrary, they have generally been observed to abate something of their virulence and progress, or sometimes entirely to cease, on the emendation of this state of the air. In Egypt and the Barbary States, as we learn from PROSPER ALPINUS,† and others, the plague always breaks up in the summer months, at which time the weather in these countries is hot and dry. But the progress of pestilential fevers is more certainly impeded by a cool dry air ; and frosty weather, or the settled cold of winter, almost always extinguishes this form of disease. In the several visitations of the yellow fever, (the malignant pestilential fever of Dr. CHISHOLM,) in the city of New-York, this disease has invariably disappeared at the approach of winter.‡

These several circumstances attending the rise, progress, and declension of putrid epidemics, afford the strongest proofs of a warm, humid

* MEAD, on the Plague, chap. i.

† PROSPER ALPINUS, *De Medicina Ægyptorum*, lib. i.

‡ HOSACK, MS. Notes on the Theory and Practice of Physic and Clinical Medicine ; Amer. Med. and Philos. Register ; HARDIE, Account of the Malignant Fever.

atmosphere being favourable to diseases of a putrescent character; though it may be much doubted whether of itself it be able to produce such an effect without the concurrence or co-operation of some other cause or causes. Heat and moisture are both of them powerfully relaxing and debilitating to the whole animal system; their principal efficacy, therefore, probably lies in rendering the body more obnoxious to the influence of a putrid infection of any kind, which, when applied, will in such a condition of the atmosphere easily produce a putrid disorder; whereas, had the air been warm and dry, or cold and dry, perhaps no such effect would have followed. Contagion or impurities of any kind are also more difficultly and slowly dispersed through a moist, than through a dry atmosphere.

Next to the warm humid, the cold humid state of the atmosphere appears to be most conducive to the origin of putrid diseases; with this difference, perhaps, that the former contributes most to the rise and progress of acute putrid disorders, as malignant and pestilential

fevers of every kind ; and the latter to slow and chronic ones, as the scurvy, &c. The cold humid atmosphere, it is true, is not so favourable to the putrefaction of dead animal matter, because heat as well as moisture, is requisite ; but the living body has naturally and constantly within itself a temperature sufficient for this process, and therefore requires not the aid of external heat. These things considered, it becomes difficult to decide whether a warm humid, or a cold humid state of the atmosphere may be most favourable to diseases of a putrescent nature.*

A *cold* and *moist* constitution of the air appears to favour the production of putrescency in the living body, chiefly in two ways. First, by obstructing perspiration, and filling the vessels with a superfluous load of noxious and putrescent juices, by which the body will be rendered more subject either to fall into spontaneous corruption, or to receive the infection of a putrid disease of any kind. And secondly, by

* ALEXANDER, Experimental Inquiry.

relaxing the fibres, and impairing the elasticity of the animal system; thereby diminishing the strength of the moving powers, and of consequence producing a languid state of the vital motions, and a greater incapacity in the body itself to resist any morbid contagion which may be applied to it.

Whatever shuts up the pores of the body, and impedes or lessens the cutaneous and pulmonary perspiration, (which moisture or dampness generally does, and that more effectually when conjoined with cold,) will have a tendency to increase the putrid diathesis of body. Cold joined with dryness and purity in the atmosphere, by keeping up a due tension in the solids, is naturally productive of diseases of the acute, or inflammatory kind. But in a cold moist state of the air, all acute and inflammatory diseases will be more apt to assume a putrid tendency. The peripneumonia typhodes, which has lately prevailed in several districts of the United States, and which has been generally terminated at the approach of warm weather, is a disease of this mixed or compound character, consisting in

a local inflammation of the lungs conjoined with a putrescent or typhoid tendency of the whole body.*

After this attempt towards investigating the principal causes of putrid diseases, and their manner of operating upon the human body, it might seem proper to say something concerning the method of curing them. But from this we are necessarily prevented. The reader will find this subject most ably treated by Dr. HUXHAM and Sir JOHN PRINGLE. From what has been said, however, relating to the causes of putrescency in the living body, it is plain, that one of the great and principal means of obviating such a condition of body, is to support the energy and activity of the living principle. The vital motions are to be preserved as near as possible to their natural standard, by endeavouring to raise and support them when they become too languid, and to curb them when they have a tendency to run too high.

* *Vide* HOSACK's Letter to Dr. BECK, in the Amer. Med. and Philos. Register, vol. iii. p. 448.

Action of Specific Morbid Poisons.

IN what manner does the specific matter of a contagious disease act on being received into the mass of blood; what parts of the human body are more especially the seat of its operation, and what are the changes effected by its action?

The peculiar kind of action by which specific contagions produce the various changes from a healthy to a diseased state, being a process imperceptibly carried on in the system, and not obvious to our senses, we can only pronounce on the nature of that action by the visible effects that are produced. These effects, though numerous, appear to depend chiefly upon an altered and contaminated state of the animal fluids; from which source all the other parts of the body may become affected. The analogy, therefore, of a *ferment*, or rather of an *assimilatory process*, in the fluids, seems most consonant to the phenomena accompanying the operation of specific contagions.

In the application of this term to the living human body we are warranted by the authority of several modern writers of eminence. "It is evident," says Dr. CULLEN, "that the contagion of the small pox acts as a ferment with respect to the human fluids, and assimilates a great part of them to its own nature."* Mr. CRUIKSHANK is decidedly of opinion that a process of this kind may take place in living matter. "Fermentation," says he, "has been chiefly observed in dead matter, and is commonly accompanied with ebullition and extrication of air; but fermentation may also take place, and I believe certainly does take place, in living matter. Ebullition, or any evident motion, is not necessary to constitute fermentation; after wine has undergone what is called its open fermentation, it continues, after it is bottled, to go through its *secret* fermentation, where no motion is evident, and every body knows requires time to ripen. All that is necessary in fermentation is, that the elementary particles be separated and recom-

* CULLEN, First Lines, vol. i. § 597.

bined, so that the matter be converted into something different from what it was before.”* The sagacious and practical Dr. WALKER remarks, that he is for many reasons “inclined to believe, that the noxious contagious matters of small pox, after making their way into the circulation, do there act as ferments, and assimilate some constituent parts of the blood into their own corrupt natures.”† Mr. BENJAMIN BELL gives it as his opinion, “that the matter of *all* contagious diseases has a power of assimilating to its own nature a certain portion, and ultimately, perhaps, the whole fluids of the body.”‡ Dr. FRANCIS, in his able and interesting paper on Mercury, has the following observation; “that certain specific morbid matters, when introduced into the system, do assimilate to their own peculiar nature the human fluids, though often in a gradual and always imperceptible manner, is still very obvious to the senses, from its effects in cases of variolous infection, and in other diseases

* CRUIKSHANK, *Anatomy of the Absorbing Vessels*, p. 111.

† WALKER, on Small Pox, p. 69.

‡ BELL, on the Venereal, vol. ii. p. 164.

of specific contagion.”* Were further authority necessary on this subject, we might add to the above the names of Dr. SIMS,† Dr. HOSACK,‡ and other distinguished modern physicians.

Doubts have, notwithstanding, been entertained whether any operation of this kind could occur in the fluids during their circulation. The most sceptical, indeed, acknowledge that contagious matter of any kind, when “lodged in the cellular texture, or other similar situation, will ferment and assimilate the surrounding humours to its own nature;” but when it passes into the circulation, say they, such a process cannot well be conceived to take place, because, forsooth, that degree of rest which appears to be requisite to every fermentative process, does not there obtain. It may, indeed, be difficult to conceive how a true fermentation can go on in

* FRANCIS, Inaugural Dissertation on Mercury.

† SIMS, Sketch of a New Theory of Cow Pock, with Remarks on Contagious Disorders; published in the Memoirs of the Medical Society of London.

‡ HOSACK, MS. Notes on the Theory and Practice of Physic and Clinical Medicine.

fluids in circulation. But surely it cannot from thence be argued that a material of the active and penetrating nature of contagion, would lose its influence merely because it is in constant motion. Contagious matter of any kind, when transmitted into the circulating mass, instead of rolling on in a friendly conjunction therewith, must necessarily mix and unite with some of the constituent parts of the blood, to which it will communicate its infectious qualities, and these again, while moving through the vessels, will more easily come in contact with other parts of the blood, which may in like manner become contaminated. Moreover, some of the contagious particles being arrested in the smaller vessels, will there ferment and assimilate the surrounding juices to their own nature ; and these being absorbed, or again returned into the circulation, will increase the infection till a considerable portion, and ultimately, perhaps, the whole fluids of the body shall become assimilated to the nature of the contagious virus introduced.

The doctrine of ferments delivered in medical writings has, very probably, like many

others, been carried to excess; but this, surely, is not a sufficient reason for denying the possibility of our fluids being susceptible of being acted upon by a ferment. This term, it must be acknowledged, as applied to express the peculiar action of contagion upon the animal fluids, is liable to objections, inasmuch as that action does not in all respects exactly correspond with the process from which the analogy is taken. There can, however, be no formidable objection to the use thereof, provided it be properly explained, or received in a qualified sense, as expressive merely of an *assimilatory process*, or one *analogous* to fermentation, by means of which, some of the constituent parts of the blood and other humours are so altered or changed in their character and properties, as to approximate to the nature and qualities of the specific contagious virus operating upon them. The blood, unquestionably, is unsusceptible of an acetous fermentation, or of an action like that which takes place among vegetable substances. But the visible effects produced, and particularly the evident multiplication and accumulation of

contagious particles generated in this fluid, in those diseases produced by the introduction of a specific contagion, as in small pox, measles, plague,* &c. are evidence sufficient for styling the process, by which such multiplication of infectious matter is accomplished, an assimilating fermentation,† though we are unable to give any precise explanation of the manner of its action. It is only by their effects that we become acquainted with many of the operations

* Notwithstanding the assertions of modern sceptics to the contrary, it is now very satisfactorily ascertained that the plague is a specific contagious disease; and, like small pox or measles, is not only communicable through the medium of the air, but also by *inoculation*. For facts on this head, see the case of Dr. WHITE, (who fell a victim to his own rashness and incredulity,) recorded in DESGENETTES, *Histoire Medicale de l'Armée de l'Orient*; also SONNINI'S *Travels in Egypt*, &c. and WITTMAN'S *Travels*, &c.

† We have been thus particular in restricting the sense of the term ferment, as applied to the living body, lest it might be supposed, that we were endeavouring to revive the ancient and justly exploded doctrine of a fermentation of the blood like that which happens among vegetable matter, than which nothing indeed could be more opposite to our intention.

of nature. Who will venture to define the precise manner in which the different changes take place in substances going through the process of fermentation. "The chemist can only show us what is produced by fermentation ; but the most skilful in that art has never attempted to explain the mode of its operation, even in dead matter ; far less can any satisfactory account be given of its operation in the living animal."

That the animal fluids become morbidly affected, in diseases of specific contagion, or are assimilated to the nature of the peculiar virus introduced into them, receives support not only from the multiplication of the infectious materials throughout the system, but is further strengthened by the communication in every instance of a disease of the same specific character with the original of the infectious matter introduced ; by the conversion of a local affection into a general or constitutional one ; and by the production of new and similar matter in different and remote parts of the body, when the infection has been only locally applied, as is observable in the production of pustules over

the whole body, in inoculated measles, small pox, &c. A portion of the matter of any of the contagious disorders is received into the living human body, and a disorder of the same kind with its original is produced, and no other. If the matter has been locally applied, as in inoculated small pox, a local affection is produced, which is ultimately succeeded by a general one, and the occurrence of pustules on various and remote parts of the body; but all of them filled with matter of the same specific nature with that generated in the part where the virus was first locally applied. Previously, however, to the production of general symptoms, a certain portion of the contagious matter must be received into the general circulation, and convert more or less of the fluids to its own nature, which process may be quick or slow in its progress, according to circumstances; but as long as the quantity of matter assimilated is inconsiderable, no marks of general disease will be produced, nor will the constitution show the effects thereof till the virus has had sufficient time to multiply and accumulate in such quantities as to

be capable of exciting some degree of morbid irritability in the solids, or in the living principle.

But the most satisfactory, not to say demonstrative evidence of the fluids becoming morbidly affected in contagious disorders, is, that the blood and other humours of persons labouring under certain of the contagious disorders, are capable of communicating the same disease to others, whose constitutions are in a condition susceptible of infection. This is a fact which those who suppose that the cause of disease is never seated in the fluids are necessarily obliged to deny. They are forced to say, that the blood in contagious diseases always remains perfectly sound, and that neither this fluid, nor any of the secretions derived from it, are capable of infecting others; an assertion without the least foundation, and disproved by almost daily experience. The experiments of DEDIER and COUZIER prove that the blood and bile are morbidly infected in the plague.* It is also well known,

* *Vide* Philos. Trans. vol. vii. Abridg.

that Dr. FRANCIS HOME practised the inoculation of measles with the blood of morbillous patients in several instances with complete success.* The communication of small pox to the *fœtus in utero*, is inexplicable on any other ground, except by supposing that the maternal blood is in a morbid state, and more or less assimilated to the nature of the variolous contagion: for the circulation through the umbilical cord being the only *free* and *direct* communication between the foetal and maternal systems, the blood is the only medium through which the unborn infant can receive, and participate in, any of the diseases of its parent.

That the foetus in utero is sometimes infected with small pox, is a fact established as the result of much experience and observation. Dr. GEORGE PEARSON has collected many well-authenticated cases of this kind from different authors; and also relates one which fell under his own personal notice.† Two instances of the small pox af-

* HOME, Medical Facts and Experiments.

† See DUNCAN's Medical Commentaries, vol. xix.

fecting the foetus in utero are recorded by Dr. MEAD.* Dr. HOSACK has related two cases of the same kind that occurred in his own practice while resident at Alexandria, in Virginia.† A case is related by Mr. TURNBULL, of a lady who, in the seventh month of her pregnancy, was inoculated, and went through the regular small pox. Nine days after the eruption she was delivered of a dead child covered with pustules, that proved to be variolous from its communicating the small pox to several persons who were inoculated with some of the matter.‡ In the case recorded by Mr. LYNN, the child, at the time of its birth, was covered all over its body with distinct pustules, which, however, were not completely filled till three days after, at which time a little matter taken from one of them communicated the disease to another child that was inoculated with it.§ Other and similar cases of

* Discourse on the Small Pox and Measles.

† DUNCAN'S Medical Commentaries, vol. xix.

‡ Memoirs of the London Medical Society, vol. iv.

§ DUNCAN'S Medical Commentaries, vol. xix.

uterine small pox have been recorded by BLAND,* DERHAM,† ROBERTS,‡ HAYGARTH,§ BURSERIUS,|| LAIRD,¶ FORBES,** JENNER,†† &c.

It is also well known, that mothers labouring under the venereal disease in a constitutional form may, and not unfrequently do, communicate the disorder to the foetus in utero : and the ulcers, too, which sometimes occur in the mouths of children born of such infected mothers, have been known to produce the same disease upon the nipples of women by whom they were suckled ; nay, these women have communicated it to other children, and these children again to other nurses.‡‡

* London Medical Journal, vol. ii.

† Philos. Trans. vol. v. Abridg.

‡ Medical Journal, vol. v.

§ On the Small Pox.

|| Institutions of the Practice of Medicine, vol. iii.

¶ Edinburgh Medical and Surgical Journal, vol. iii. p. 155.

** Edinburgh Medical and Surgical Journal, vol. iii. p. 307.

†† Med. and Chirurg. Transactions, vol. i.

‡‡ *Vide* BELL, on Gonorr. Virul. and Lues Ven. vol. ii. ; UNDERWOOD, Diseases of Children ; MAHON, on the Ven. Infect. in Pregnant Women.

A healthy child may receive the venereal affection by sucking an infected nurse, of which two remarkable cases fell under the observation of Dr. Hosack; which satisfactorily prove, that not only the blood, but also the secretions derived from it, are capable of communicating venereal affections. We may also remark, that one of the infants which had been thus infected produced the same disease upon the nipples of another nurse by whom it was suckled.*

From all that has been said upon the present subject, it appears most just and rational to conclude, that the specific morbid poisons of the different contagious disorders act primarily and more especially upon the animal fluids, in converting and assimilating them to their own corrupt and infectious qualities; and that the solids are chiefly and ultimately affected in a secondary way only, being excited by this morbid state of the fluids to some degree of unusual or inordi-

* Hosack, MS. Notes on the Theory and Practice of Physic and Clinical Medicine.

nate exertion, which is uniformly productive of various morbid phenomena, according to the peculiar kind of virus, the state of the constitution, and the condition of the living principle itself.

ON
THE MORBID QUANTITY
OF
THE FLUIDS.

As it respects the *quantity* of circulating fluids in the human body, they may become the source of disease either through *excess* or *deficiency*; which constitute the *πολυχυμία* and *ὀλιγοχυμία* of pathologists. A paucity or mere deficiency of healthy fluids seldom happens, except from some copious and sudden evacuation, or from famine; nor can it be long sustained without being attended with a vitiated quality, from the debility or prostrated vigour of the functions. A *defect* in the quantity of fluids, therefore, is scarcely an object of the present exercise. But an *excess* in the quantity of them, or as it is usually called *plethora*, being of more frequent occurrence, requires a more particular attention.

Plethora.

WHEN the general mass of circulating fluids is accumulated beyond that degree which is conducive to the perfection of health, there arises what the schools have denominated a *plethora*, or morbid fulness of the blood-vessels. There are few states of the system, perhaps, more troublesome than this over fulness of the vessels, especially when it has become habitual, or is of long standing, and begins to produce languor and oppression. It renders the body perpetually obnoxious to the most grievous, and even the most fatal disorders.* Every medical person must have heard of the famous declaration of

* Nihil est, si forsan venena et animi affectus exceperis, quod tantam ruinam ac perniciem corpori minetur, atque illud tam gravibus morbis obnoxium reddat, quam nimia succorum abundantia; quia vires premit et motibus impulsoriis resistit, unde tardior fit sanguinis progressus, segniores etiam excretiones, a quibus tamen salvis præcipuæ sanitatis functiones dependent. HOFFMAN, *Medicin. Rational. System.* tom. ii. p. 434.

HIPPOCRATES,* with regard to the *athletic*, or the full habited; and, in imitation of whom, CELSUS elegantly observes, si plenior aliquis, et speciosior, et coloratio factus est, suspecta habere bona sua debet. Quæ quia neque in eodem habitu subsistere, neque ultra progredi possunt, fere retro, quasi ruina quadam, revolvuntur.†

By a plethora physicians understand an excess or exuberance of good blood only; that is, where all the component parts of this fluid are equally increased in quantity. The consequences of an excess of either of the component parts of the blood, may be easily understood from preceding observations under the head of morbid fluidity. We have now to speak only of the excess of the whole mass.

* Ἐν τοῖσι γυμνασικοῖσιν, αἱ ἐπὶ ἄπρον εὐεξίαι σφαλεραί, ἣν ἢ τῷ ἰσχυρῶς ἔωσιν. οὐ γὰρ δύνανται μένειν ἐν τῷ αὐτῷ, οὐδὲ ἀτρεμεῖν. ἐπὶ δὲ οὐκ ἀτρεμεῖσιν, οὐκ ἔτι δύνανται ἐπὶ τὸ βέλτιον ἐπιδιδόναι· λείπεται οὖν ἐπὶ τὸ χειρόν. τουτέων οὖν εἵνεκεν τὴν εὐεξίαν λέγουσιν συμφορὰν μὴ βεβαίαν.

HIPPOCRATES, lib. i. *Aphor.* 8.

† CELSUS, lib. ii. cap. 2.

Pathologists have enumerated different species of plethora,* which it may not be improper briefly to explain. The ancients, as we learn from GALEN,† PAULUS,‡ AVICENNA,§ and others, divided it into two kinds: of these, one relates to the vessels, and was denominated a *plethora ad vasa*, and sometimes, *ad molem*, or *ad venas*; the other has a reference to the strength

* See HOFFMAN, *Medicin. Rational. System.* tom. ii.; GAUBIUS, *Patholog*; LUDWIG, *De Plethoræ Differentiis*; GREGORY, *Conspectus Medicinæ*; &c.

† — Duas in universum notiones, relationésve plenitudinis proponamus: unam quidem, secundum robur viresque illius qui talem plenitudinem defert: alteram secundum excipientis vasis capacitatem. GALEN, *De Plenitudine*.

‡ Copia vero ipsius sanguinis duplici modo capi demonstrata est: uno *ad vires*, venæ licet plenæ non appareant; in quo statu homo protinus infirmatur, et viribus destituitur, natura seu ad grave aliquod onus ferendum impotente. Altero *ad vasa*, quæ id continent, in alia pondus loca transfundere spectantur: et si virtus haud cum molestia ipsum toleret. PAULUS, lib. vi. cap. 40.

§ Repletio secundum duos existit modos. Est etenim repletio secundum vasa, et est repletio secundum virtutem, &c. AVICENNA, *Opera*, lib. i. fen. ii. doct. 3. cap. 6. ..

or natural powers, and was called a *plethora ad vires*. The former is always and properly a true or absolute fulness; but the latter is so relatively with respect to the natural powers only. Physicians have mentioned two other kinds of plethora, viz. a *plethora ad spatium*, and a *plethora ad volumen*.

By the *plethora ad vasa*, we are to understand a real exuberance of the absolute quantity of blood, or such a morbid accumulation of it within the vessels, as incommodes their actions by too much weight and distention. It occurs most generally in persons of strong, robust constitutions, who have vigorous digestive powers, are full feeders, and take but little exercise. In more lax habits, it is seen by the redness and turgescence of the minute vessels; but the larger vessels, on the contrary, are more distended in firmer habits.

The *plethora ad vires* supposes a greater quantity of blood than the strength will bear, without being overpowered and oppressed with the load. The vessels are not necessarily too full in themselves, but yet contain more than the

weakness of the moving powers is able to propel. This kind of plethora, therefore, must be relative to the constitution of the patient. An excessive plenitude, if not timely relieved, always becomes more or less of a burden, even to the most robust. We may also frequently have occasion to observe, that a small redundance of fluids, endured with impunity by the strong, will become oppressive, and sometimes even intolerable, to the weak. The plethora *ad vires*, therefore, has a just foundation, and may even exist under various forms. We may add, too, that it is probably a more frequent source of disease than is generally suspected, and particularly difficult to relieve, inasmuch as it is mostly peculiar to lax habits of body, in whom the slightest diminution of the circulating fluids is not unfrequently productive of faintness, from the want of a due contractile power in the vessels.

The *plethora ad spatium* arises from the constriction or diminution of the capacities of the vessels, the quantity and the bulk of the circulating fluids remaining the same. Consequently,

it is a plethora relatively to space only, and owes its origin altogether to a constriction or impervious state of some of the vessels; as happens from cold weather, or from the accession of the cold fits of fevers, when in weak habits hemorrhages have sometimes been the consequence. It also arises in advanced life from an obliteration or impervious state of many of the smaller vessels.

The *plethora ad volumen*, which is also called apparent or spurious, arises from an expansion or augmentation of the volume of circulating fluids, their quantity remaining unaltered. It happens from a great or sudden diminution of the pressure of the atmosphere, but more commonly from great heat, either external or internal, and the consequence of ardent and inflammatory fevers, severe exercise, violent passions, spirituous liquors, friction, &c.

It is obvious that these different species of plethora are not inconsistent with each other; but they may all of them be occasionally combined in the same individual; and the disease arising from such a union will of consequence

be more dangerous, and sometimes productive of sudden death. In the common acceptation of the term, however, plethora implies a fulness as to the vessels; and in this sense it is chiefly used in the following pages.

The quantity of the whole mass of blood cannot easily be reduced to measure; nor, indeed, is the proportion as to quantity or bulk so exactly limited, that every excess induces disease. The latitude of health, which comprehends age, sex, temperament, manner of living, &c. admits of some considerable variety in this respect. A small redundance easily endured by some may become a burden to others. But whenever the general mass of fluids is accumulated to such a degree, as by the superabundant load to have a tendency to overcome the power of the vessels, and to produce general languor and oppression, it then becomes morbid; and if not timely relieved may prove the source of various and even fatal diseases. Such an overfulness of the vessels is generated by all those causes, which produce a large quantity of laudable chyle and blood, and at the same time

prevent their attenuation and waste.* To this end contribute a vigorous and healthy state of the digestive powers, together with a more lax and distensile contexture of the blood-vessels; a liberal indulgence in a rich luxurious diet, and particularly the free use of animal food, with wine and other fermented liquors; tranquillity of mind; an indolent and sedentary manner of life, and much sleep, especially in those who have before been accustomed to active bodily exercise; a suppression of habitual discharges, whether natural or artificial; but above all others, an obstruction or gradual diminution of perspiration; and lastly, the habit of frequent blood-letting, provided the body be not entirely debilitated thereby, has also a tendency to create a plethoric state of the system, both by weakening the action of the arteries, and of consequence diminishing in proportion the excretions; and by relaxing the vessels themselves, so as to dis-

* Plethoram generat omnis causa, quæ multum laudabilis chyli, et sanguinis conficit, simulque horum attenuationem, consumptionem, perspirationem, impedit. BOERHAAVE, *Aphor.* 106.

pose them to fill more easily. It is owing to these circumstances, that losses of blood, whether artificial or spontaneous, if within certain bounds, are commonly so soon recovered; and where these losses are frequent they contribute to produce or increase the plethoric state of the system, by creating a disposition to generate much blood, as well as by rendering the resistance of the vessels more weak, so as easily to yield to a preternatural accumulation of fluids. Women, by a natural constitution, monthly evacuate their superfluous blood; and just in the same term their vessels recover their former fulness and tension. They are in a special manner inclined to a plethoric state of the system, after the natural cessation of the menses; and such preternatural fulness of their blood-vessels, if not relieved by occasional bleedings, in imitation of their former evacuations, not unfrequently lays the foundation of the most obstinate and fatal diseases. Men used to frequent evacuations of blood are, in like manner, obliged to have their vessels regularly emptied at their accustomed periods of bleeding, otherwise they

suffer the same inconveniences as women do by the suppression or retention of their menses. Winter and spring are also favourable to the rise of plethora ; and cold and temperate regions, rather than places that are hot and dry.

A morbid fulness of the blood-vessels, therefore, is more especially the complaint of the sedentary, inactive, and relaxed, who indulge too liberally in generous diet and drinks. It occurs chiefly in the luxurious female, whose pampered appetite is the means of preparing a superabundance of chyle and blood, whose lax and distensile vessels easily yield to an incumbent load of fluids, and whose secretions, from habits of idleness and inactivity, are slow and inconsiderable. Men of laxer habits, whose vessels in weak resistance approach the female, in similar situations, are equally prone to a preternatural fulness of the vascular system.

A plethora of the blood-vessels is said to be the complaint chiefly of youth and middle age ; but it is also a frequent occurrence in more advanced life, that is, after the period of forty-five

or fifty ; for, as it has been judiciously observed, "although the system may be debilitated by age, it should be recollected that the secretions are also impaired from diminished exercise at that period of life, and that an accumulation takes place in the larger vessels, especially in the venous system."* It is certain that many women, after the natural cessation of the menses, (which in our climate generally takes place at about forty-five,) are more inclined to a general plethora of the sanguiferous system, than at any previous period of life ; and such fulness, if not occasionally relieved by the use of blood-letting, in imitation of their former monthly evacuations, not unfrequently lays the foundation of the most dangerous and incurable diseases. Some females, at that time of life, frequently require as large, or perhaps more copious extractions of blood, than at the earlier periods of life ; and this principle of practice holds equally good with regard to robust men with large ves-

* HOSACK, Quarterly Report of the Diseases of New-York, in the Amer. Med. and Philos. Register, vol. i.

sels, and to persons who are accustomed to free and generous living, or who labour under a suppression of some habitual discharge.

It is a common, though palpable error, to affirm, that evacuations by the lancet are absolutely improper in advanced life ; as if persons at this period were so far from being subject to repletion of the blood-vessels, that they were rather afflicted by inanition. It is true, indeed, that all persons, in advanced life, are not necessarily plethoric, and consequently do not require depletion by the lancet ; nor does age of itself, independent of all other circumstances, contribute to an over fulness of the sanguiferous system. But at the same time, it must be recollected, that there are some sound, vigorous, and robust old persons, who are possessed of capacious vessels, and not only liberally indulge in the free use of nutritious aliments, but also have strong digestive and assimilating powers, capable of converting the most solid food into laudable chyle and blood ; in consequence of which it is not to be doubted that accumulations will take place in the vascular system, which, indeed, is

sufficiently obvious from the florid colour of the countenance, and the turgescence of the vessels themselves. But, moreover, the body in advanced life is less fitted for motion or active exercise; whence the excretions must be more slow and inconsiderable, and cannot bear a due proportion to the *ingesta*. And as little blood is consumed by heat, motion, and nutrition, there must necessarily be produced a superabundance of fluids, and a plenitude or overloaded state of the vessels; which, unless seasonably and occasionally removed by the use of the lancet, or some salutary effort of nature itself, will frequently lay the foundation for many of the complaints incident to advanced life; such as giddiness, apoplexy, palsy, numbness of the extremities, gout, hemorrhoids, dropsical effusions, coughs, difficulty of breathing, hydrothorax, angina pectoris, visceral obstructions, itchings or erysipelatous eruptions, calcareous concretions, affections of the urinary organs, pains in the joints, &c. which often arise from or are connected with a plethoric state of the system.

The timid and preposterous conduct of those physicians who object altogether to evacuations by the lancet in the diseases of advanced life, cannot be too severely reprobated. The same may be said concerning the neglect of this remedy in those premonitory symptoms of apoplexy and palsy which proceed from an overloaded state of the blood-vessels. We are by no means, however, to conclude, that blood-letting would be proper in all persons in advanced life. On the contrary, in such as are not affected with any fulness of the vessels, but are weak and languid, who have lost their appetite and digestive powers, or labour under a weakness of the stomach and intestines, and especially in those who have long been afflicted with some chronical disorder, this evacuation would be manifestly injurious, if not productive of the most serious consequences.

But where there is a plethora, or fulness of the sanguiferous vessels, age alone can certainly afford no objection to the use of the lancet. Our celebrated countryman, Dr. RUSH, to whose learning and talents the medical literature of this

country is so much indebted, in a particular manner, recommends bleeding in the acute diseases of advanced life, which are attended with plethora, and an inflammatory action of the pulse. He further observes, that he has even seen many of the *chronic* complaints of old people mitigated by it. "The degrees of appetite," says he, "which belong to old age, the quality of the food taken, and the sedentary life which is generally connected with it, all concur to produce that state of the system, which requires the above evacuation."* The observation and experience of Dr. Hosack, during a long and extensive practice, are in corroboration of the preceding opinions; and the same mode of treatment has accordingly been recommended by him, with an earnestness arising from a conviction of its importance. In his quarterly reports on the diseases of the city of New-York, among other observations of the same import, are the following: "We have before remarked, that the use of the lancet is

* RUSH, Medical Inquiries and Observations, vol. i.

especially indicated in the plethora of advanced life, when the excretions are necessarily diminished from the diminished action of the excretory vessels. We cannot withhold the expression of our surprise, that this opinion should be resisted by the practitioners of our city, as we observe it has been in a variety of instances; and by men too, whose education and whose opportunities of observation should have given them different views of this subject, and have led them to different practice.”*

Many instances might be produced to show that evacuations by the lancet are not only useful to persons in advanced life, but, also, powerfully contribute to prolong life, and to preserve the body free from many of the complaints incident to old age. We are informed by WEPFER,† that almost all the Swiss, even when eighty or ninety years of age, use blood-letting every year, as a means of warding off diseases.

* *Vide* Amer. Med. and Philos. Register, vol. iii.

† WEPFER, De Apoplexia.

Would our limits permit, we might here adduce many facts to prove, that age may commodiously bear evacuations of blood. Dr. Hosack mentions the case of a female patient, in the eighty-fifth year of her age, who, "in the course of three days, lost by hemorrhage from the lungs, at the least calculation, two quarts of blood. Very nearly as much more, in the same period of time, was taken from her arm, when the hemorrhage ceased." He further adds, that "she has since recovered, without any injury to her constitution, from the loss of blood she has sustained."* It is well known, that persons extremely old not unfrequently discharge large quantities of blood from the hemorrhoidal veins, without any remarkable loss of strength. Drs. Hosack and Francis have recently had under their care a lady of this city, upwards of seventy years of age, who formerly laboured under a hemorrhoidal discharge, but has for the last two years been subject to violent and frequent at-

* *Vide* Quarterly Report of the Diseases of the City of New-York, in the Amer. Med. and Philos. Register, vol. iii.

tacks of apoplexy, removable only by the liberal use of the lancet, which has been employed no less than thirty times within the space of twelve months, and with uniform success. The patient at present enjoys much better health than for many years before. But the writer forbears to enlarge under this head. He might record the particulars of many other cases of a similar nature which have occurred in the practice of his preceptor, and which have fallen under his own immediate observation.

The existence of a plethora or redundancy of blood is easily ascertained by the habits of life, together with certain appearances and feelings of the patient. The principal symptoms by which it is characterized are, inordinate redness of the whole body, and more especially of the face; repletion and distension of the vessels; and a particular kind of pulsation in the arteries, which always feel full, or of considerable size, hardly receding from the finger, so that a very small difference is perceptible between their contraction and relaxation. The pulse, however, does not always convey a perfect idea of

this state of the system, and without caution might often mislead an inaccurate observer. Sometimes it is strong and hard, but more frequently is obscure or oppressed, and often apparently weak and low ; but when firmly pressed the artery does not easily give way, nor is the current of blood checked. If, observes Mr. BROMFIELD,* three or four fingers cover a considerable length of artery, and we press hard for a time on it, and then suddenly raise all the fingers, but *that* nearest the patient's hand, the influx of blood, if there be a *plethora*, will be so rapid, as to raise the other finger, and make us sensible of the fulness.

This particular feel of the pulsation of the arteries in plethora has been called *oppression* of the pulse, and may be easily understood by considering plenitude in the extreme ; for it is obvious that an artery surcharged with blood is as incapable of producing a strong, free, and bounding pulse, from its inability to contract freely

* BROMFIELD, Chirurgical Observations and Cases, vol. i. p. 58.

upon, and get rid of, the superabundant load of fluids, as from want of a due quantity for its distension. To an inattentive observer the pulse will, in both cases, appear low and weak. From this circumstance arises the curious phenomena of the circulation becoming more accelerated, and the pulse stronger, after bleeding a plethoric person. By diminishing the superabundant quantity of fluids, it restores the over distended vessels to their former contractions and elasticity, and thus necessarily increases the momentum of the circulation. It is on this principle that moderate evacuations of blood often remove obstructions and promote suppressed excretions, not only of blood, but also of urine and perspiration.* The extraction of a few ounces of blood from a plethoric female often almost instantaneously restores the menstrual discharge. HOFFMAN† remarks, that he has frequently observed the hemorrhoidal discharge, after having been long stopped, restored by venesection.

* BOERHAAVE, Institut. Med. § 1223.

† HOFFMAN, Medicin. Rational. System. tom. iii. p. 553.

HIPPOCRATES* informs us, that blood-letting removes a difficulty or suppression of urine. RIVERIUS† also affirms, that after venesection the urine has not only been evacuated more copiously, but also of a deeper colour. It is frequently of great importance to take away a due and proper quantity of blood, from persons whose vessels are overcharged. HOFFMAN‡ observes, that he has known many instances, where in an extreme degree of plethora the extraction of a small quantity of blood only, as for instance two or three ounces, has a few hours after been succeeded by an apoplectic fit, which has been happily removed by a liberal venesection in the arm. But it may here on the other hand be remarked, that the very copious and repeated evacuations by the lancet prescribed by some practitioners, in cases of apoplexy and palsy, are necessarily injurious, even in the most athletic, and “not to be justified either by reason-

* HIPPOCRATES, lib. vi. Aphor. 36.

† RIVERIUS, Cent. prim. Observ. 1. 48. &c.

‡ HOFFMAN, Medicin. Rational. System. tom. iii. p. 569.

ing or practice." Such large and sudden evacuations of blood, by prostrating the powers of life, leave the already torpid and paralyzed vessels in a state of collapse and inaction, from which they frequently never recover.

Beside the symptoms or appearances already enumerated, the existence of a preternatural fulness of the blood-vessels is further pointed out by its effects upon the body; and particularly by pains in the head, back, and loins, frequent vertigo or giddiness, numbness of the extremities, a somewhat anxious or oppressive breathing which is at times attended with a peculiar sense of straitness of the trachea, general lassitude and oppression, especially after an increase of motion or heat in the weather, disinclination to exercise, whether of body or mind, dulness with frequent drowsiness, or a strong propensity to sleep.

Such are the symptoms which supply us with a perfect diagnostic of plethora, which, in a more extreme or inordinate degree, often produces transitory disturbances of some or all the senses, and even impairs the intellectual faculties, and

more especially the memory. For the mind, to perform its functions with acuteness and precision, requires a free, delicate, and moveable state of the brain and nerves, which renders them more susceptible of impressions, or the motions subservient to thought. But such mobility and sensibility of the brain and nerves is necessarily impaired by the compression occasioned by an over distension of the blood-vessels.

It may be here remarked, that the veins in the beginning of life, as appears from the experiments of Sir CLIFTON WINTRINGHAM,* are considerably more dense and strong than the arteries. But the latter, on account of the continual pressure and distension which they necessarily suffer from the action of the heart, are daily increasing in density and strength, till at length they not only equal, but even surpass the force of the veins, which from not being subject to the same power of the heart are little, if at all, increased in this respect, but remain nearly the

* Experimental Inquiry on some parts of the Animal Structure.

same throughout life. It is owing to this circumstance that the proportional quantities of blood in the arteries and veins must change in the course of life, and that if a general and preternatural plethoric state occur in early life, it must especially appear in the arterial system; but at an advanced period such plethora will show itself chiefly in the venous system. For the density of the arteries with respect to that of the veins being greater in early than in advanced life, it must necessarily happen that the resistance to the passage of the blood from the arteries into the veins, is greater in young than in old persons; and so long as this resistance continues, the arterial system will be the most inclined to a preternatural fulness. But since the density of the arteries is constantly increasing, whilst that of the veins remains nearly the same, it is obvious that the resistance of the former will, in time, not only balance, but prevail over that of the latter; and whenever this takes place, (which, in the human body, is generally supposed to be about the age of thirty-five,) a proportionably greater quantity of blood will be thrown into

the veins, and by this means the fulness of the arteries will be in some measure taken off, so that the occurrence of a general plethora of the system, after this period, must especially manifest itself in the veins. Hence appears the reason of the different diseases incident to certain periods of life, as also why many disorders of the young gradually wear off, and sometimes entirely disappear without any assistance from art, as the body approaches to its greatest strength and maturity. Nor is it less apparent why many of those affections which are incident to age should gradually increase notwithstanding the interposition of the greatest skill to prevent it.

The females of most or perhaps of all animals have their arteries more capacious and lax, compared with the veins, and the veins themselves much smaller than the males of the same species.* Owing to these circumstances women, *ceteris paribus*, are more disposed to a plenitude than men.

* GREGORY, *Conspectus Medicinæ*.

Diseases of Plethora.

MANY are the evils which arise from an overfulness and distention of the blood-vessels. It sometimes produces oppression of the strength, with irritability and languor.* But more frequently, perhaps, the distended vessels are rendered prone to vehement or inordinate motions. The equilibrium between the solids and fluids being destroyed by an over proportion of the latter, the freedom and equability of the circulation are necessarily impaired. Whilst the blood, by its too great quantity, strongly resists the contractile and elastic force of the heart, arteries, and other vessels, its progressive motion through the whole body is

* Multa mala a nimia plenitudine oriuntur. Homo nonnunquam fere opprimitur, hebes, languidus, debilis fit, neque ipsa quæ sanguinem movent organa ad tantum onus impellendum valent. Pulsus languet, et aliquando *syncope*, et vertigo, et palpitatio observantur. Sæpius vero vasa nimis distenta, ad motus præter solitum vehementes et abnormes proclivia fiunt. GREGORY, *Conspectus Medicinæ*, § 509.

not only retarded, so that it becomes more apt to degenerate into impurities, and form obstructions of various kinds, but, further, in irritable habits, and in highly nervous parts, by exciting spasmodic strictures, or violent and inordinate action, it induces inequalities in the distribution of blood, and occasions preternatural congestions or accumulations of the same in particular parts of the sanguiferous system.

A consideration of these circumstances will lead to a knowledge of the various affections, both acute and chronic, that either proceed from, or are aggravated by, a plethora. It predisposes to febrile and inflammatory diseases, apoplexy, and palsy ; to preternatural congestions ; to obstructions, and indurations of glandular organs ; to extravasations, hydropical effusions, rupture of the blood-vessels, and hemorrhage. Moreover, on account of the pain and irritation produced by the distending blood, in the more nervous and membranous parts of the body, excessive mobility, and a disposition to *spasmodic* affections, and other diseases of the same kind, not unfrequently arise from plenitude. HIPPOCRATES has

very justly observed that spasms proceed from immoderate repletion, as well as from depletion, or too small a quantity of the animal fluids:

Σπασμοὶ γίνονται ἢ ὑπὸ πλεθωσίου, ἢ κενωσίου.* Repletion of the vessels, however, is not equally productive of spasm, or convulsive action in every person, nor in every part of the body. This action occurs most frequently in irritable habits, and takes place in those parts only which are highly membranous, or are liberally supplied with nerves; so, according to the difference of these, there is produced a greater or less tendency to spasmodic and other similar disorders.† Nervous irritations and spasmodic or convulsive affections of different kinds are doubtless frequently to be attributed to, or are kept up by,

* HIPPOCRATES, Aphor. 39. lib. vi.

† Ubiunque sanguis intra membranas nerveas et carneas subsistit, stagnat, easque valde distendit, ibi dolor et spasmus gignitur, qui tanto vehementior est aliasque nerveas simul partes in consensum abripit liberumque et æquabilem sanguinis circuitum præpedit, quanto stagnatio et repletio vasorum major est, et quo exquisitoris membranæ sensationis sunt ac validiorem potentiam motricem habent. HOFFMAN, *Medicin. Rational. System.* tom. ii. p. 436.

plethora and distention of the blood-vessels. Dr. DARWIN remarks, that venesection will often instantaneously relieve those nervous pains which attend the cold periods of hysteric, asthmatic, or epileptic diseases; and that even when large doses of opium have been in vain exhibited. In these cases, says he, the pulse becomes stronger after the bleeding, and the extremities regain their natural warmth; and opium then given acts with much more certain effects.* We are informed by Dr. CULLEN, that hysteria more especially affects females of the most sanguine and plethoric habits, and frequently those, too, of the most robust and masculine constitutions.† Females who menstruate too sparingly, or who labour under an entire suppression of this evacuation, by which the vessels of the uterine system and other sensible parts of the body become over distended with blood, are not only affected with violent pains in the head, back, loins, and other parts of the body, but are

* DARWIN, *Zoonomia*, vol. ii. p. 41.]

† CULLEN, *First Lines*, § 1517.

in like manner subject to spasms, convulsions, and other affections common to hysteric persons. Suppression of urine and of the catamenia may also proceed from too great fulness of the vessels of the kidneys, and of the uterus; and consequently in such cases they may be frequently and most effectually restored by blood-letting.

The effects of a redundance of blood are particularly observable in the head, in which the circulation is naturally very slow, and the vessels themselves of a delicate structure; both of which circumstances are peculiarly favourable to the formation of preternatural congestions. Hence it is, that plethoric persons are so frequently carried off by apoplexy, a vessel being ruptured in the brain. It is to be presumed, however, that an actual rupture of the vessels, or an effusion either of blood or serum, are not always necessary to the production of this disease; but that it may, and indeed does sometimes proceed merely from too great fulness of the large vessels of the brain. For the head being naturally entirely full, and the hard bone of the cranium incapable of yielding, it follows that if the

larger vessels which carry red blood be distended beyond their natural bulk, the smaller ones will necessarily be compressed, and the functions of the head thereby disordered. And thus, as VAN SWIETEN* has justly remarked, may all the diseases of the brain, from a slight vertigo to a mortal apoplexy, take their rise from a plethora.

The heart and lungs are also among the parts that are often affected by an exuberance of fluids. The blood being too great in quantity is with difficulty thrown into the vessels. Whence the circulation becomes laborious, the heart itself is oppressed, and sometimes palpitation and syncope ensue. From the resistance, too, that is made to the blood, which is driven from the left ventricle of the heart, the pulmonary veins will be less able to empty themselves into that organ, and, therefore, accumulations will necessarily take place in the lungs. Owing to this turgescence of the blood in the pulmonary vessels, plethoric persons are not unfrequently

* VAN SWIETEN, Commentar. § 106.

the subjects of hemoptysis; and for the same reason they are often liable to habitual catarrhal affections, to hoarseness, to difficulty of breathing, and effusion of water in the chest.

But if a plethoric state of the general system, and particularly of the venous vessels, take place, it is to be presumed that it will especially affect the abdominal viscera, or those parts connected with the system of the *vena portarum*. The great number, size, and dependent situation of those veins which form the *vena portarum*, and the want of valves in them to support the perpendicular columns of blood, all contribute to retard the circulation, and to render the motion of the venous blood more slow here than elsewhere. The evils, as Dr. HOFFMAN remarks, which proceed from this retarded motion and consequent accumulation of blood in the vessels of the abdomen, arise sometimes from irritation and spasmodic stricture of the membranous and nervous parts, excited by the distending blood, and sometimes from a loss of tone in the viscera, or from obstructions and indurations. Many of the diseases of the bowels and other

abdominal viscera may therefore proceed from a turgescence of the blood in the vessels of these organs.* Sometimes the distended vessels unload themselves by excessive hemorrhages from the liver, stomach, and intestines. But as no part of the abdomen is more largely supplied with blood than the liver, so there is none more liable to diseases proceeding from this cause.

Among the disorders arising from a general plethora of the system, we have enumerated dropsies, or those morbid accumulations of watery or serous fluids that sometimes take place in different parts of the body. That dropsy depends frequently, or, perhaps, in a majority of cases, upon this cause is amply confirmed by the experience of many who have enjoyed extensive opportunities of observation in this disease. Experience, says Dr. HOSACK, has long since taught me that dropsy arises as often, nay, more frequently, from increased exha-

* *Vide* DEWAR, Observations on Diarrhœa and Dysentery ; HOSACK, Quarterly Report of the Diseases of New-York, in the Amer. Med. and Philos. Register, vol. ii.

lation, the effects of an overloaded state of the blood-vessels, than from diminished absorption, occasioned from a loss of tone in the absorbent vessels; and consequently this affection may, and no doubt frequently does, proceed from the want of blood-letting as well as from the excessive use of that evacuation. I have seldom, if ever, says he, attended a case of dropsy of the chest that did not arise from increased exhalation, and, in almost every instance, the complaint has been removed by blood-letting and other evacuants. The same may be said of the hydrocephalus of adults, which is always, I consider, preceded by, or accompanied with, inflammation.*

In confirmation of the correctness of these opinions, the writer could, in this place, record many instances of hydrothorax, ascites, and anasarca produced by such fulness of the sanguiferous system, and which were relieved by venesection, and other depleting remedies. The following cases, however, which occurred in the practice of his preceptor, must suffice :

* MS. Notes on Hosack's Lectures.

“A gentleman of this city, a Mr. C——L, about sixty years old, was unable to lie down for nearly three months, owing to an accumulation of water in the chest, attended with cough, laborious respiration, and diminished secretion of urine, accompanied, at the same time, with a degree of anasarca swelling of the lower extremities. But by means of repeated bleeding, and the combination of calomel and squills, the symptoms above mentioned have totally disappeared; and, by the subsequent use of tonics, he has so far recovered his strength as to return to his usual active occupation. In another case, the patient, in his seventy-seventh year, of a plethoric habit of body, has, within the last six weeks, been attacked both with ascites and anasarca combined, attended with all the characteristic symptoms of those diseases. As these were induced from the want of exercise, the patient at the same time taking his customary food and stimulant drinks, the depleting treatment was deemed expedient. Fourteen ounces of blood were accordingly taken from his arm, followed with repeated doses of rhubarb, and the sulphate

of potash. During the use of these remedies, his usual drinks, which consisted of spirits, or brandy and water, as well as the use of animal food, were continued, but in less quantity than ordinary. The tumour of the belly, and swelling of the extremities, were sensibly diminished by the evacuations procured, and by the subsequent use of chalybeates and other tonics, his health is perfectly re-established."* The case of the late Dr. DANCER, who was for many years a distinguished practitioner in the West-Indies, affords another example equally instructive. Having for more than twelve months, in Jamaica, laboured under all the characteristic symptoms of hydrothorax, with evident ascites and general anasarca, he, in July, 1810, came to the city of New-York, and placed himself under the care of Dr. HOSACK. As he was now somewhat advanced in life, had been a free and generous liver, and withal was naturally of a robust plethoric habit of body, there was little

* HOSACK, Quarterly Report of the Diseases of New-York, in the Amer. Med. and Philos. Register, vol. iii.

difficulty in discovering the nature and source of his complaint, and the treatment necessary to be pursued. Accordingly, after the operation of paracentesis, (by which eight quarts of fluid were drawn off,) and of liberal and repeated venesection, together with other depleting remedies and corresponding treatment, the symptoms of his disorder subsided, and in a short time his general health was so far recovered as to enable him to perform a tour of several hundred miles through the country. In the ensuing November he departed for the West-Indies.

Dropsy from general plethora appears to be a much more frequent occurrence in advanced than in early life. It is probably owing to this circumstance, that the fulness of the venous system, which seems to increase as life advances, is greater in late than in early life. But every accumulation that takes place in the veins must necessarily resist the free passage of the arterial blood into them, and consequently there will be a greater resistance at the extremities of the arteries. This again must be productive of preternatural congestions in the extremities of the red

arteries, and therefore of some increased action in them, which, superadded to the *vis a tergo* or impulsive action of the heart, must determine the fluids with more than usual force upon the extremities of the arteries and the exhalent vessels proceeding from them; the special effect of which will be to produce an increased effusion from the exhalent vessels. In this manner, it is to be presumed that hydrothorax, ascites, and other forms of dropsy arise so frequently from plethora of the blood-vessels, particularly in advanced life, and might frequently be prevented by the use of the lancet.

This distinction between the different kinds of dropsies, when arising from diminished absorption, the consequence of debility of the absorbents, or from increased exhalation, the effect of plethora and excessive action, necessarily leads to the most important practical application.* As in the latter kind there is an urgent

* From not adverting to this distinction between the different species of dropsy, and the treatment indicated in each, may doubtless be attributed the pernicious effects which have so fre-

call for the use of the lancet, so in the former, this treatment is to be as carefully avoided. The writer is aware that the opinions here expressed, as to the nature and character of different sorts of dropsies, and especially the mode of treatment he has recommended, will, by the majority of physicians, be considered as heresies. But as it respects blood-letting, the use of which it is his object particularly to recommend in dropsies connected with a general plethora of the system, he may observe, that it has been pur-

quently been observed to follow the indiscriminate use of the digitalis in this disease. The digitalis can be employed with advantage in those kinds of dropsies only which arise from a general plethora or fulness of the blood-vessels. "I have frequently witnessed the exhibition of digitalis, in substance and in tincture, in many cases of ascites and in general dropsy which have occurred in the New-York Hospital. The remedy, in a large majority of cases, was exhibited in the secondary stage of the disorder, when symptoms of fulness or preternatural excitement did not exist. In no case of this nature was the use of the digitalis followed with salutary effects; on the contrary, it added to the debility under which the patient already laboured, and, instead of mitigating, augmented the disorder." *MS. Notes on FRANCIS' Lectures on Materia Medica.*

sued with the most decidedly beneficial effects in the practice of his preceptor. He may also remark, that the use of blood-letting in dropsy has long since been sanctioned by the authority of LEONARDUS BOTALLUS, a celebrated physician of the sixteenth century, and more recently by our late distinguished countrymen, Dr. RUSH, and also by Dr. BLACKALL of London, in his late valuable Treatise on Dropsies.

Another disease which appears to depend chiefly upon an overloaded condition of the blood-vessels, is *angina pectoris*. For the first accurate and satisfactory account of the symptoms of this disorder, the world is indebted to Dr. WILLIAM HEBERDEN* of London. Cases of an affection, however, in many respects similar, had been previously observed and recorded in the writings of HOFFMAN† and MORGAGNI‡.

With respect to the nature and causes of *angina pectoris*, physicians have entertained a

* Medical Transactions, vol. ii.

† Consultationes Medicæ, vol. i.

‡ De Sed. et Caus. Morborum.

great diversity of opinion. From the limited view which has generally been taken of this disorder, by merely regarding it as characterized by some remarkable symptom or appearance, to the exclusion of others equally important, and more especially its connexion with the whole system, physicians, in many instances, have necessarily, though inadvertantly, been led into error. Dr. HEBERDEN* supposed it to be owing to *spasm*, or convulsion of the part affected. Dr. WALL† mentions a case in which he attributed the origin of the complaint to a rigidity or induration of the semi-lunar valves at the beginning of the aorta. A similar opinion is entertained by Dr. MATTHEW BAILLIE, relative to the ossification of the valves of the heart. Other morbid appearances, such as preternatural accumulations of fat‡ about the heart, and an enlargement of that organ or of the greater vessels, have been mentioned among the causes of angina

* Medical Transactions, vol. ii.

† Medical Transactions, vol. iii.

‡ MACBRIDE, Medical Observ. and Inquir. vol. vi.

pectoris. A gouty humour, spasm of the heart, anxiety, and excessive indulgence of the vehement emotions of the mind, are likewise enumerated as causes. Dr. BERGIUS, a Swedish physician, considers this complaint as a kind of spasmodic asthma. ELMER and SCHMIDT, of Germany, also believe it to be a species of asthma: and of the same opinion was Dr. DARWIN, who denominates it *asthma dolirificum*.

Dr. PARRY,* a distinguished writer, has lately endeavoured to show that angina pectoris arises from an ossification of the coronary arteries of the heart, an opinion which seems to have gained many able advocates, and among others may be mentioned Dr. JOHN AUGUSTINE SMITH, professor of anatomy and surgery in the University of the State of New-York. Several objections might be urged against this theory of Dr. PARRY.

In the first place, angina pectoris generally occurs in advanced life, when such ossifications are not uncommon in different parts of the body.

* Inquiry into the Symptoms and Causes of Syncope Anginosa.

Ossified coronaries, therefore, are rather to be considered as an accidental circumstance.

Secondly, cases of ossified coronaries are recorded of patients who did not labour under the symptoms essential to this disease.*

Thirdly, but the great and indeed fatal objection to the theory of Dr. PARRY, and of all others founded upon ossifications or other derangements about the heart, is, that this organ and its appendages in several well authenticated cases of angina pectoris have, upon dissection, been found in their natural state. A case of this complaint is recorded in the Medical and Physical Journal,† and another by Dr. HOSACK, in the American Medical and Philosophical Register,‡ in both of which it is expressly stated that the coronary vessels were free from disease or any ossification.

Dr. HOSACK, who has met with several cases of angina pectoris in his practice, taking into

* *Vide* WARREN'S Cases of Organic Diseases of the Heart; and, also, MORGAGNI, De Sed. et Caus. Morb.

† Vol. xvi. p. 487.

‡ Vol. ii. p. 471.

view the circumstances connected with this complaint, and particularly the time of life, the habit of body, and the season of the year in which it, for the most part, occurs, is induced to consider the disease as most generally proceeding from a *plethora* of the blood-vessels, more especially from a disproportionate accumulation *in the heart and larger arteries*.* The deposits of fat observed upon dissection, as well as the effusions of water in the thorax and pericardium, the enlargement of the heart, the preternaturally distended state of the vessels themselves, and even the bony deposits occasionally met with in the heart and its appendages, are all, he considers, favourable to this conclusion, these being for the most part the effects of plethora.† In further confirmation of the correctness of his opinions, it may be remarked, that it appears from the histories of this complaint, that the persons the most subject to it are those advanced in life, of sedentary and gouty habits, with short necks,

* Amer. Med. and Philos. Register, vol. ii.

† MS. Notes on Hosack's Lectures.

and who are full feeders, and inclined to be corpulent. Hemorrhages, or spontaneous discharges of blood from different parts of the body, anxious and oppressive breathing, numbness of the extremities, and giddiness, have often been observed in persons subject to this disease, and are all evidences of an overloaded state of the blood-vessels. The successful treatment, too, of angina pectoris by active cathartics, blood-letting, and other evacuants, calculated to diminish the fulness of the vessels, can leave no doubt of its relation to plethora.

But the writer forbears to enlarge upon this subject. For a more ample view of this opinion with regard to the nature of angina pectoris, he refers the reader to an interesting Dissertation on this subject, published by his fellow graduate, Dr. HENRY BOGART.

The last disease which we shall mention, in connexion with the present subject, is gout. That this complaint is frequently aggravated by, and in many respects dependent upon, a plethora of the blood-vessels, receives confirmation from the following circumstances :

First, The subjects of gout are generally persons advanced in life, who are naturally of a robust, full habit of body, and who have been accustomed to a sedentary indolent manner of living, a full, voluptuous diet, and the too free use of wine or other spirituous and fermented liquors.* Women who seldom indulge in habits of intemperance in eating and drinking, are as seldom the subjects of gout; and when they are attacked with this complaint it is usually after the cessation of the catamenia, or such as happen to be of a robust, corpulent habit of body, and at the same time lead a life of indolence and intemperance.

Secondly, " Its associate or vicarious diseases, apoplexy, palsy, asthma, habitual catarrh, eruptions on the skin, obstructed viscera, and dropsy, arise from the same habit of body, and from the same causes."†

Thirdly, Gout rarely attacks persons who live much upon vegetable aliment, or who are

* *Vide* SYDENHAM, Treatise on the Gout.

† HOSACK, Amer. Med. and Philos. Register, vol. iv.

remarkable for their excessive discharges by the skin. Those, too, who are employed in constant bodily labour, are seldom the subjects of this complaint, even though they at the same time liberally indulge in the excesses both of the table and bottle; for by active bodily exercise the secretions are duly kept up, and the vessels thereby prevented from becoming surcharged with fluids.

Fourthly, The collections of *lithiat of soda*, or other saline or earthy materials, found upon the joints in gout, are usually the effects of an overloaded condition of the blood-vessels, producing an atony or loss of tone in the secerning and excretory vessels, and a consequent impaired state of the secretions and excretions.

Lastly, The utility of blood-letting in this disease, a practice sanctioned by the truly respectable authority of SYDENHAM, HUXHAM, MACBRIDE, CULLEN, RUSH, and HOSACK, is further in proof of its frequent connexion with plethora.

Thus much of the diseases of plethora. With regard to its cure or prevention little need here

be said. As the causes of plethora are intemperance and indolence, so the best means of preventing this complaint are temperance and exercise. But when the disease is already formed, the cure is to be effected by bleeding and other evacuants, together with a more abstemious diet, and exercise both of body and mind. For as the cause of this disease is too much blood, so whatever diminishes the quantity of it must also diminish the fulness of the vessels. But the most ready way of effecting this is by bleeding, which immediately relieves all the symptoms of plethora. In this respect we are but imitating nature herself, which often removes an inordinate fulness of the vessels by a salutary hemorrhage.

But as the vessels from being continually overdistended lose their natural tone and elasticity, there are few conditions of the system in which irritability and oppression of strength are more considerable and troublesome, than in an inordinate and habitual plethora. To relieve it, therefore, is not unfrequently a task of no small difficulty. "Bleeding, sometimes attended with a little temporary relief, is occasionally followed by

fainting; and after a little time the former fulness, and the debility, with irritability, are increased. Evacuations by the intestines, and a feebler diet, occasion faintness, and exercise is attended with intolerable fatigue. No other plans will, however, succeed, and each must be used in such a gradual, guarded manner, as to prevent uneasiness." After the fulness of the vessels have, in this manner, been in part diminished, tonics and cold bathing may safely and advantageously be used.

We cannot conclude this essay without again adverting to the importance of blood-letting when indicated in the plethora of advanced life. Experience, says Dr. RUSH, proves it to be more necessary, under equal circumstances, in that stage of life than in any other.

FINIS.

APR 9 1937

